bp

Stephen A. K. Palmer
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BP Legal Western Region Downstream

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October 31, 2005

VIA OVERNIGHT MAIL

Linda Mangrum
U.S. Environmental Protection Agency
Remedial Enforcement Support
77 W. Jackson Blvd., SR-6J
Chicago, IL 60604-3590

Re: **Residential Portion of the USS Lead Site, 5300 Kennedy Avenue, East Chicago, Indiana – Response to EPA 104(e) Request for Information**

Dear Madame:

This letter constitutes the response of Atlantic Richfield Company ("ARC" or the "Respondent") to the U.S. Environmental Protection Agency's August 15, 2005 CERCLA Section 104 Request for Information (the "Request") regarding the residential portion of the USS Lead Site, 5300 Kennedy Avenue, East Chicago, Indiana. ARC is responding on behalf of ARC. Please be advised that Anaconda Lead Products Company ("ALPC") was dissolved in 1936 and International Smelting Company ("ISC") ceased to exist as of January 1, 1973. Reference is also made to the telephone call held on August 29, 2005 between Steve Kaiser and Cathy Colbert of this office, in which EPA granted ARC until October 15, 2005 to respond to the Request. Reference is also made to a telephone call held on October 13, 2005 between Larry Kite of EPA and Cathy Colbert, in which EPA granted ARC an extension until October 31, 2005 to respond to the Request.

ARC appreciates the extension of time to allow preparation of this response. To formulate this response, ARC reviewed its internal document archives for information and records regarding the matters addressed in the Request. This considerable effort was completed for ARC to respond to the best of its knowledge and in good faith to the Request, and fulfill ARC's obligations under Section 104(e) of CERCLA, 42 U.S.C. § 9604(e). Nonetheless, if new documents or information become available, ARC will supplement this response, and ARC representatives are

available to explain the response and answer any questions that may arise from the EPA's review of the enclosed information and documents.

General Objections

ARC objects generally to the Request to the extent that it seeks information that is beyond the scope of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) Section 104(e) or is protected by the attorney-client privilege, the attorney work product doctrine, the self-evaluation privilege or any other applicable privilege. ARC also objects generally to the Request as overly broad and unduly burdensome to the extent that it contains redundant requests and also seeks copies of documents that are in the public domain, including documents in the files of any branch of the U.S. government, state government or any local government. Notwithstanding this objection, ARC has made a good faith effort to locate responsive documents and information within its custody and control that address matters related to the Site.

Without waiving or limiting its General Objections, ARC makes the following objection to Definition no. 7 on the grounds that it violates the right to privacy provided by the California Constitution, Article I, Section 1, to the extent that it requests confidential information about current or former employees, such as their home addresses and telephone numbers.

Please be advised that this response does not constitute, nor shall it be construed to be an admission of liability by ARC with respect to any claims, demands, causes of action, releases or allegations set forth in the Request or made by any person with regard to the Site. ARC reserves the right to supplement this Response should additional information or documents become available.

Subject to the foregoing general objections and any specific objections set forth in ARC's responses below, and upon information and belief, ARC responds as follows:

Response to Request

1. *Identify all persons consulted in the preparation of the answers to these questions.*

Response to Question No. 1

ARC incorporates the general objections stated above. Without waiving these objections, ARC has identified all persons consulted in the preparation of the answers.

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William Voth, Esq.
Attorney
Arnold & Porter
399 Park Avenue
New York, New York 10022-4690
(212) 715 - 1006

2. *Identify all documents consulted, examined, or referred to in the preparation of the answers to these questions, and provide copies of all such documents.*

Response to Question No. 2

ARC incorporates the general objections stated above. Without waiving these objections, ARC will provide all non-privileged documents, consulted, examined or referred to in preparation of the answers or that contain information responsive to the questions.

3. *If you have reasons to believe that there may be persons able to provide a more detailed or more complete response to any question in this Information Request or who may be able to provide additional responsive documents, identify such persons.*

Response to Question No. 3

ARC incorporates the general objections stated above. Without waiving these objections, ARC responds that Eagle-Picher Company and/or Mid-West Tar Products Corporation may be able to provide a more detailed or complete response to any question or may be able to provide additional responsive documents.

4. *List your EPA Identification Numbers.*

Response to Question No. 4

ARC incorporates the general objections stated above. In addition, ARC objects to this question to the extent that it is overly broad and unduly burdensome in that it seeks information not relevant to the subject matter of the Request. To the extent that this question seeks an EPA Identification Number that might have some relationship to ARC's operations in East Chicago, Indiana ARC states that ARC never owned or conducted any lead operations in East Chicago and, therefore, has no such numbers. ISC and ALPC, which no longer exist, divested their plants in East Chicago decades before the creation of the Environmental Protection Agency and consequently they have no such numbers.

5. *Identify the acts or omissions of any person, other than your employee, contractors, or agents, that may have caused the release or threat of release of hazardous substances, pollutants, or contaminants that may have migrated to or been deposited upon the Site.*

Response to Question No. 5

ARC incorporates the general objections stated above. ARC further objects to this question on the grounds that the term "acts and omissions" is vague and ambiguous. In addition, EPA is asking that ARC speculate on the acts or omissions of persons outside of ARC's custody and control. Without waiving these objections, ARC responds that it is unaware of any acts or omissions that may have caused the release or threat of release of hazardous substances, pollutants, or contaminants at the Site.

6. *Identify all persons, including current and former employees of International Smelting Co./Atlantic Richfield Company/Anaconda Lead Products Company (herein after, "the Company") located in East Chicago, Indiana (herein after, "the Facility"), and its contractors and subcontractors, having knowledge or information about the generation, transportation, treatment, placement, disposal, or other handling of hazardous substances, at the Facility, or the migration or disposal of hazardous substances at the Site.*

Response to Question No. 6

ARC incorporates the general objections stated above. ARC further objects to this question on the grounds that it is overly broad and unduly burdensome. ARC has never owned or operated a lead facility in East Chicago, Indiana and is not aware of any living persons who have knowledge or information about the generation, transportation, treatment, placement, disposal, or other handling of hazardous substances, at the Facility, or the migration or disposal of hazardous substances at the Site. In addition, ISC and APLC have not owned or operated a facility in East Chicago for approximately 60 years.

7. *Please identify the years of operations for the International Smelting Co./Atlantic Richfield Company/Anaconda Lead Products facility located in East Chicago, Indiana.*

Response to Question No. 7

ARC incorporates the general objections stated above. Without waiving these objections, ARC responds it has never conducted operations at the Site. From 1919 to 1936, ALPC operated a white lead plant at the Site. International Lead Refining Company operated a lead refinery from 1914 – 1934, and a Zinc Oxide Department from 1922 – 1934, at the Site. In 1934, International Lead Refining Company was dissolved. ISC, which reorganized and changed its name to International Smelting and Refining Company in 1934, (hereafter collectively "ISR") continued to operate the lead refinery and Zinc Oxide plant in East Chicago, Indiana from 1934 to 1946. Following the dissolution of ALPC in 1936, ISR operated the white lead plant until its sale in 1946. In September 1946, ISR sold to Eagle-Picher Company the property on which the white lead plant, lead refinery and zinc oxide plant were located, together with all buildings, fixtures, machines, materials and supplies, and items on order. In January 1949, ISR sold the northern portion of the property to Mid-West Tar Products Corporation. Documents bates-numbered BPL000000001 – BPL000000108 are responsive to this question.

8. *Please describe in general terms the production processes performed by the Company at the Facility.*

Response to Question No. 8

ARC incorporates the general objections stated above. ARC further objects to use of the phrase "production processes," as such phrase is vague, ambiguous, and overly broad. Without waiving these objections, ARC responds that ARC never owned or conducted operations at the Facility. Documents numbered BPL000000068 - BPL000000175 describe the production processes performed by International Lead Refining Company, ALPC, and ISR.

9. *Please identify any permits issued by either the United States Environmental Protection Agency or the Indiana Department of Environmental Management that govern the type or quantity of air emissions by the Company at the Facility.*

Response to Question No. 9

ARC incorporates the general objections stated above. Without waiving these objections, ARC responds that ARC never owned or conducted any operations at the Facility and, therefore, no permit was ever issued to it. ISR and ALPC, which no longer exist, divested their plants in East Chicago years before the creation of the Environmental Protection Agency or the Indiana Department of Environmental Management and therefore, have no permits responsive to this question.

10. *Please state whether the Company used lead or lead-containing materials in the process. Please provide the following:*

    A. *A description of how the Company used lead or lead-containing materials in the process;*
    B. *The years during which the Company used lead or lead-containing materials in the production process;*
    C. *The quantities of lead or lead-containing materials the Company used annually in the production process;*
    D. *A description of the processing capacity or throughput of the process using lead or lead-containing materials;*
    E. *An estimate of the volume of lead or lead-containing material emitted annually into the air.*

Response to Question No. 10

ARC incorporates the general objections stated above. In addition, ARC objects to this question on the grounds that it assumes ARC, ALPC or ISR emitted lead or lead-containing material into the air. Without waiving these objections, ARC states that it never owned or conducted operations at the Facility and, therefore, never used lead or lead-containing materials. With respect to ALPC and ISR, please refer to the documents provided by ARC and bates numbered BPL000000109 – BPL00000 0175 as a response to Question 10A through 10D. With respect to sub-part 10E, ARC does not have any information or knowledge regarding the volume of lead or lead-containing material, if any, emitted annually into the air.

11. *Please state whether the Company monitored air emissions from the Facility. If the Company did monitor air emissions from the Facility, please provide the following:*

    A. *A description of the type of air monitoring performed;*
    B. *A description of the years during which the Company performed air emissions monitoring;*
    C. *A description of the results of the air emissions monitoring;*
    D. *The identity of the person or persons who performed the air emissions monitoring;*
    E. *A copy of any reports, memoranda, notes, letters or documents referencing the air emissions monitoring or summarizing the results of the air emissions monitoring.*

Response to Question No. 11

ARC incorporates the general objections stated above. Without waiving these objections, ARC states that ARC never owned or conducted operations at the Facility. ARC has not located any documents that indicate that ALPC or ISR ever monitored air emissions from the facility.

12. *Please state whether the Company has observed air emissions at the Facility that resulted in a non-attainment event. If the Company has observed air emissions that resulted in a non-attainment event, please provide the following:*

A. The date and time of the non-attainment event;
B. The type of emission that caused the non-attainment event;
C. The duration of the non-attainment event;
D. An estimate of the volume of material released into the air between the time the non-attainment event began and the time it took for the Company to restore operations to attain compliance with air emissions limits;
E. A description of the manner in which the Company determined that a non-attainment event had occurred, and,
F. A description of the steps taken by the Company to restore operations to attain compliance with air emissions limits.

Response to Question No. 12

ARC incorporates the general objections stated above. ARC further objects to this question on the grounds that the term "non-attainment event" is vague and ambiguous. Without waiving these objections ARC states that ARC never owned or conducted operations at the Facility. ARC has not located any documents that suggest or indicate that ALPC or ISR ever observed air emissions at the Facility that resulted in a non-attainment event.

13. *Please state whether the Company caused or allowed materials located or generated within the boundaries of the Facility to be used as fill material at a location or locations beyond the boundaries of the Facility. If the Company did cause or allow materials located or generated within boundaries of the Facility to be used as fill material at a location or locations beyond the boundaries of the Facility, please provide the following:*

A. A description of when materials were removed from the Facility to be used as fill;
B. A description of the type and volume of material removed from the Facility to be used as fill; and,
C. A description of the location or locations where materials located or generated within the boundaries of the Facility were placed for use as fill material.

Response to Question No. 13

ARC incorporates the general objections stated above. Without waiving these objections, ARC states that ARC never owned or conducted operations at the Facility. ARC has not located any documents that suggest or indicate that ALPC or ISR ever caused or allowed materials located or generated

within the boundaries of the Facility to be used as fill material at a location or locations beyond the boundaries of the Facility.

Very truly yours,

Stephen A. Palmer

Encl.

Cc: Cindy Kezos (w/encl)

RESIDENTIAL PORTION OF USS LEAD SITE
EAST CHICAGO, INDIANA

ATLANTIC RICHFIELD COMPANY
RESPONSE TO EPA'S AUGUST 15, 2005
104(E) REQUEST FOR INFORMATION

DOCUMENTS RESPONSIVE TO QUESTION #7

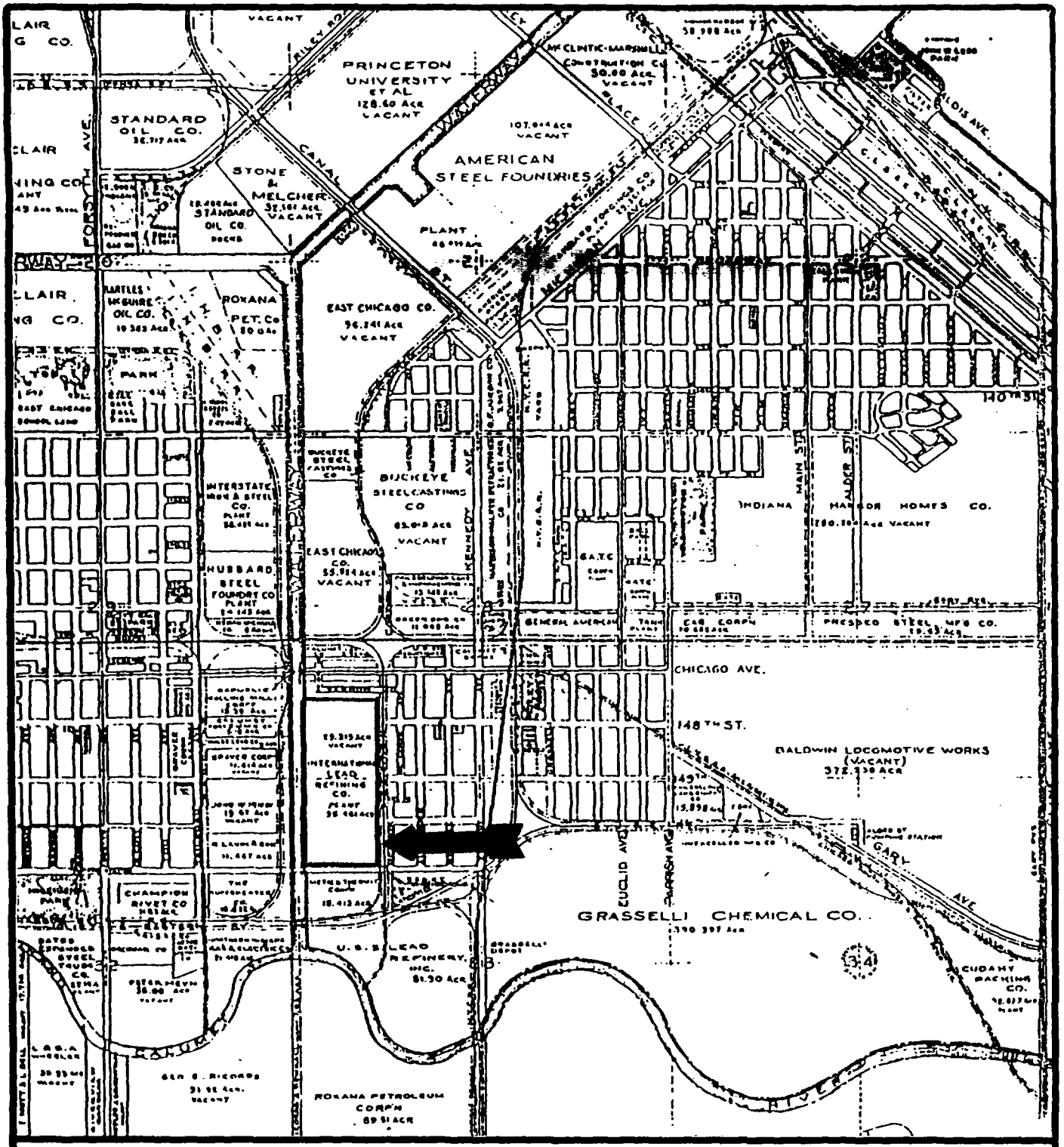

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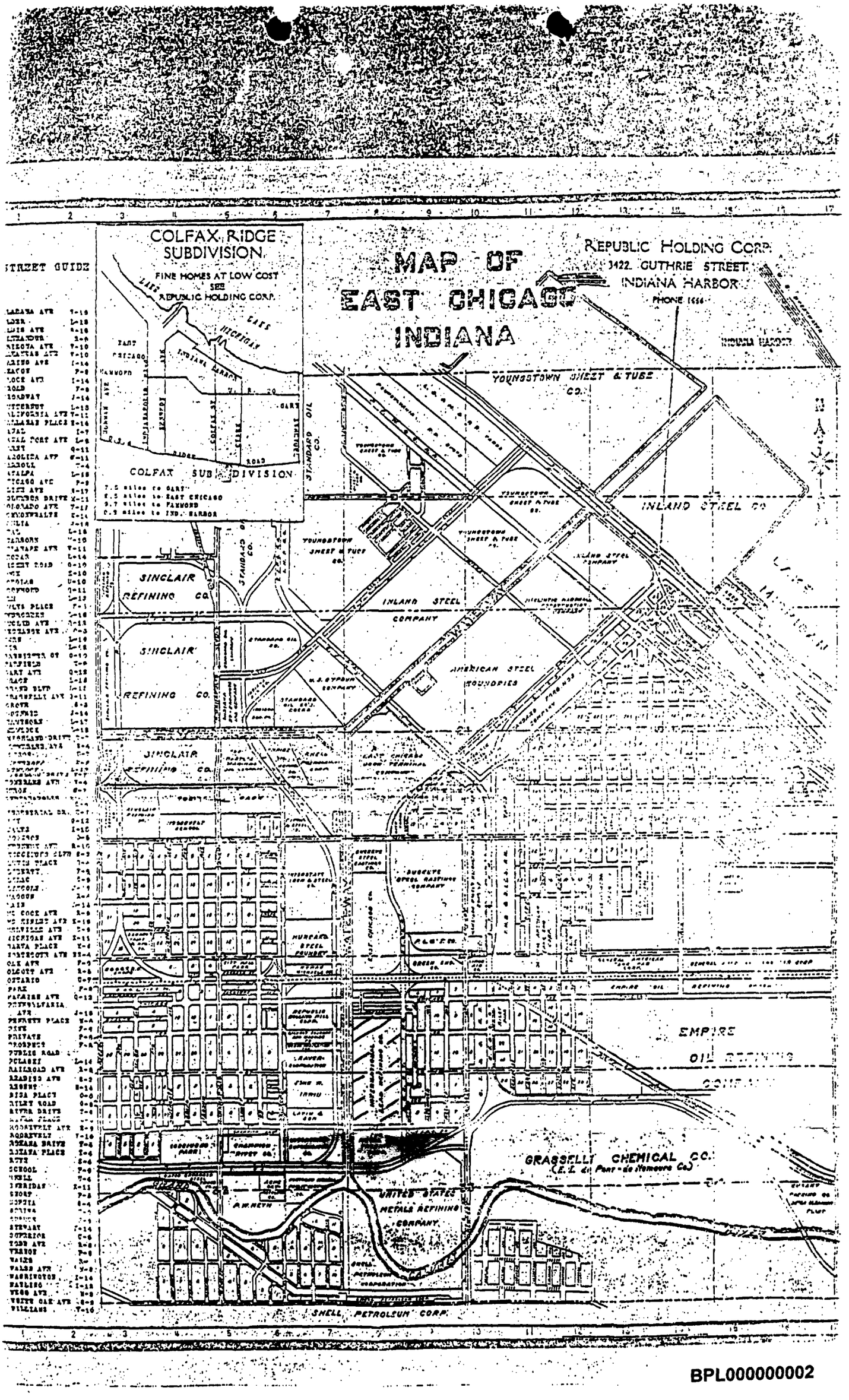
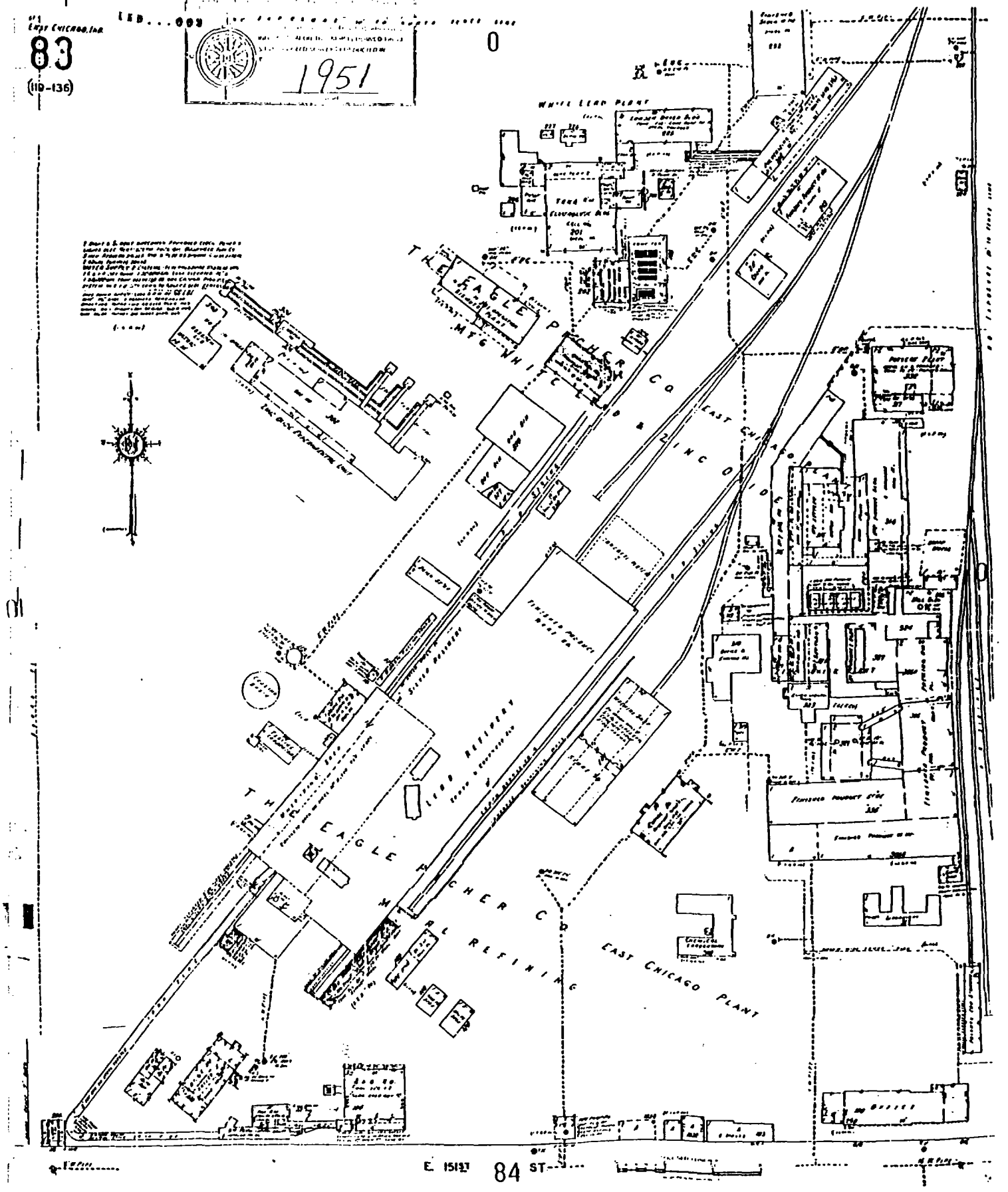
Figure 1

Site Vicinity Map	
PHR	Chamber of Commerce Map, 1926
	420 East 151st Street
	East Chicago, Indiana
	225-004-3

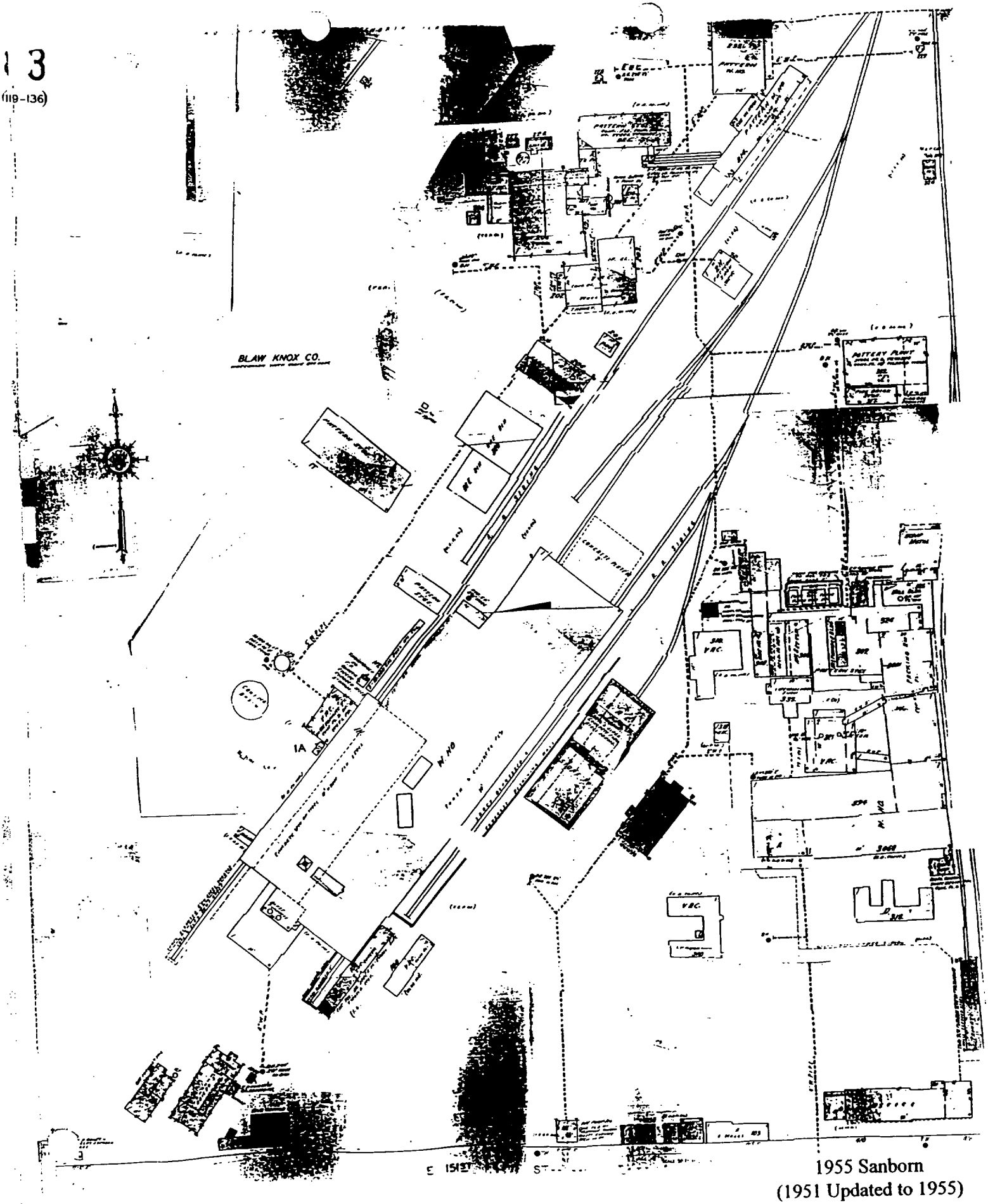
BPL000000001



BPL000000002

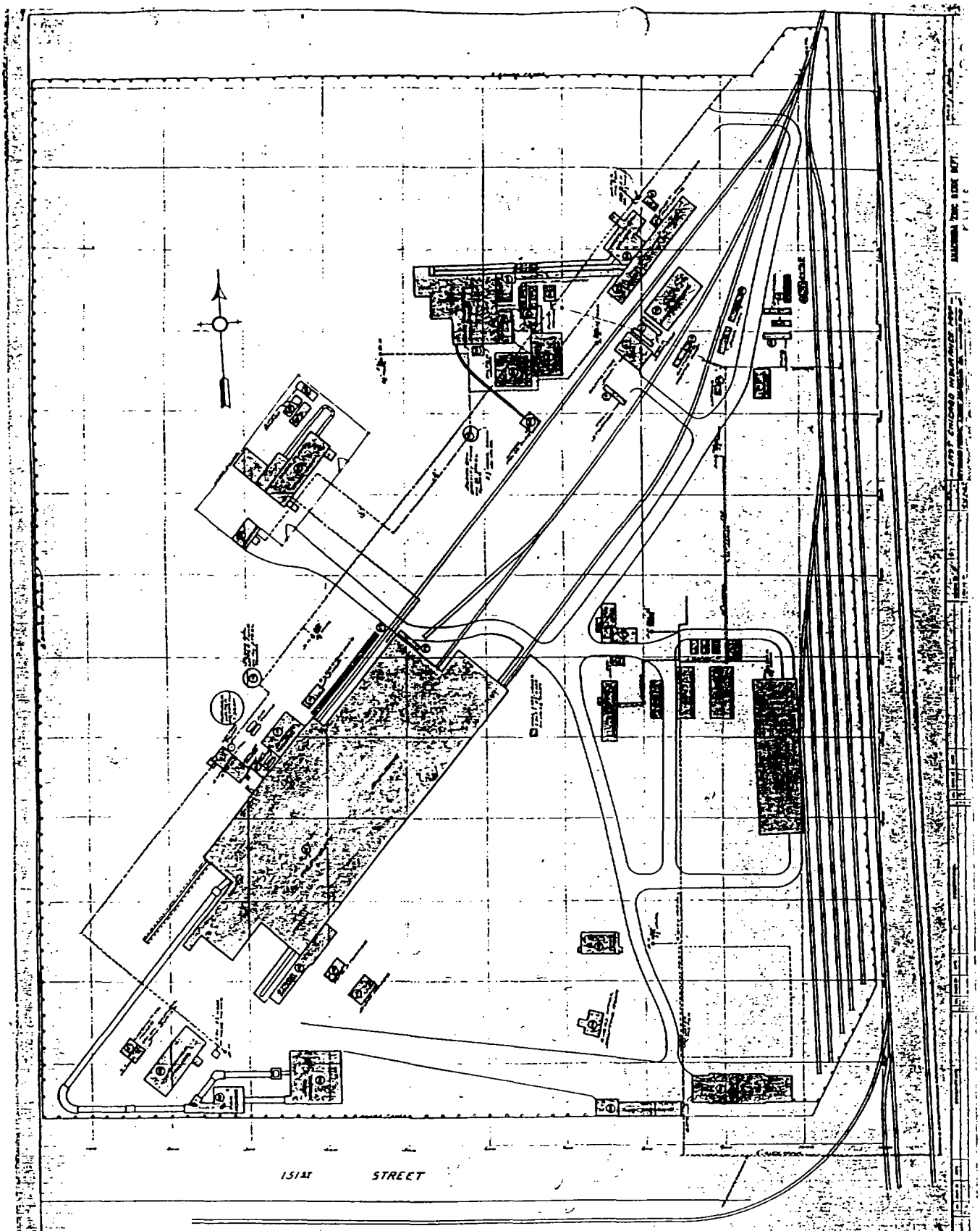


1951 Sanborn
(1930 Updated to 1951)



1955 Sanborn
(1951 Updated to 1955)

BPL000000004



472

M S Dean

International Lead Ref . Co

This indenture witnesseth that Maurice S Dean and Hester Orr Dean,his wife of Chicago,County of Cook and State of Illinois,for the sum of one dollar ($1.00) and other good and valuable considerations,convey and warrant to the International Lead Refining Company,a corporation of the State of Indiana,the following described real estate,to-wit:-

The triangular piece of land in the southeast corner of block thirteen (13)as shown by the recorded plat of the Subdivision of the southwest quarter (SW¼) of section twenty eight (28) township thirty seven (37) north,range nine (9) west of the Second principal meridian,situated in the City of East Chicago,County of Lake and State of Indiana,and more particularly described as follows:- Beginning at a point on the south line of said block thirteen (13) one hundred and twenty (120) feet west of the southeast corner thereof;thence running easterly on said south line for a distance of ninety (90) feet,thence northerly on a line parallel to and thirty (30) feet west of the east line of said block thirteen (13) for a distance of one hundred and sixty (160) feet,thence on a straight line in a southwesterly direction to the point of beginning,containing 0.1651 acres,more or less;

Also part of block four (4) in the Subdivision of part of the northwest quarter (NW¼) of section thirty three (33) township thirty seven (37) north,range nine (9) west of the Second principal meridian,in Lake County,Indiana,described as follows:- Beginning at a point on the north line of section thirty three (33) aforesaid,one hundred (100) feet east of the northwest corner thereof;thence east on the north line of section thirty three (33) aforesaid eleven hundred two and thirty-four hundredths (1102.34) feet to its intersection with a line parallel to and thirty (30) feet west of the west line of the seventy five (75) feet right of way of the Baltimore & Ohio Chicago Terminal Railroad Company;thence south on last described line eleven hundred twenty one and ninety six hundredths (1121.96) feet;thence southwesterly on a straight line one hundred eighty and thirty three hundredths (180.33) feet to a point ninety (90) feet west of the last described line and on a line parallel to and forty five (45) feet north of a line drawn from a point on the north and south center line midway between the north quarter corner and the center of said section thirty three (33) west to a point on the west line of section thirty three (33) aforesaid,thirteen hundred and twenty (1320) feet south of the northwest corner thereof;thence west on the last described line ten hundred and fifteen and seventy seven hundredths (1015.77) feet to its intersection with a line parallel to and one hundred (100) feet east of the west line of section thirty three (33) aforesaid,and thence north of last described line thirteen hundred twenty and fifty nine hundredths (1320.59) feet to the point of beginning,containing thirty two and two hundred thirty thousandths (32.230) acres more or less.This conveyance covers all right,title and interest of the grantor of,in and to any land lying in the bed of any street,road, avenue or waterway,open or proposed,in front of or adjoining said premises to the center line thereof (except the north ½ of the 151st Street adjoining said described premises) and all right,title and interest of the grantor of,in and to any and all railroad rights of way in front of or adjoining said premises.

This conveyance is made subject to

1:- The general taxes after the year 1911.

2:- All unpaid instellments of all special assessments levied upon said premises, or any part thereof,and due and payable subsequent to the date hereof.

In witness whereof we have hereunto set our hands and seals this 3rd day of April AD 1912.

Maurice S Dean (Seal)
Hester Orr Dean (Seal)

State of Illinois,County of Cook,ss

I,Hyman Rosenberg,a Notary Public,in and for the said County,in the State aforesaid, do hereby certify that Maurice S Dean and Hester Orr Dean,his wife,personally known to me to be the same persons whose names are subscribed to the foregoing instrument, appeared before me this day in person,and acknowledged that they signed,sealed and delivered the said instrument as their free and voluntary act,for the uses and purposes therein set forth,including the release and waiver of the right of homestead.

Given under my hand and notarial seal this 15th day of April AD 1912.

Hyman Rosenberg,Notary Public.

Seal.

Filed April 19,1912 at 10 A.M.

Recorder.

Book 179, Page 472
April 3, 1912

THIS INDENTURE WITNESSETH, That the East Chicago Company a corporation of the State of Indiana, for the sum of One ($1.) Dollar and other good and valuable considerations, Conveys and Warrants to the International Lead Refining Company, an Indiana corporation, the following described real estate, to-wit:

Lot thirty-seven (37) in Block twelve (12) except the North two hundred and sixty-nine and four-tenths (269.4) feet thereof, and except the East thirty (30) feet thereof; also Block thirteen (13) except the East thirty (30) feet thereof, and except a triangular piece in the Southeast corner thereof, as conveyed by deed dated March 22nd., 1912, to Maurice S. Dean, all in the Subdivision of the Southwest quarter (SW¼) of Section twenty-eight (28) Township thirty-seven (37) North, Range nine (9) West of the Second Principal Meridian, in Lake County, Indiana, being more particularly described as follows:

Beginning at the point of intersection of the South line of Section twenty-eight (28) aforesaid with a line parallel to and one hundred (100) feet East of the West line thereof, thence North on last described line eleven hundred sixty-one and seven-tenths (1161.7) feet more or less, to its intersection with a line parallel to and two hundred and sixty-nine and four-tenths (269.4) feet South of the North line of Lot thirty-seven (37) in Block twelve (12) aforesaid; thence East along last described line eleven hundred and two (1102) feet to a line parallel to and thirty (30) feet West of the West line of the Seventy five (75) foot right of way of the Baltimore & Ohio Chicago Terminal Railroad Company; thence South along said last described line ten hundred and eleven and twenty-four hundredths (1011.24) feet to a point one hundred and sixty (160) feet North of the South line of Section twenty-eight (28) aforesaid, thence Southwesterly on a straight line one hundred and eighty-one and six-hundredths (181.06) feet to a point in the South line of Section Twenty-eight (28) aforesaid, which is one hundred and twenty (120) feet West of the West line of the Seventy-five (75) foot right of Way of the Baltimor & Ohio Chicago Terminal Railroad Company aforesaid; and thence West ten hundred and twelve (1012) feet to the point of beginning.

Also the North Half (N½) of 151st Street (subject to the rights of the public therein) described as follows, to-wit: The South forty-five (45) feet (except the East one hundred and twenty (120) feet thereof) of Block Four (4) in a subdivision of part of the Northwest Quarter (NW¼) of Section thirty-three (33) Township thirty-seven (37) North, Range nine (9) West of the Second Principal Meridian, in Lake County, Indiana, containing in all the land hereby conveyed thirty and three hundred eighty-five-thousandths (30.385) acres more or less.

This conveyance covers all right, title and interest of the grantor of, in and to any lands lying in the bed of any street, road, avenue or waterway, open or proposed, in front of or adjoinging said premises to the center line thereof.

This conveyance is made subject to:

1: The general taxes levied after the year 1912;

2: All unpaid installments of all special assessments levied upon said premises, or any part thereof, due and payable subsequent to the date hereof.

IN WITNESS WHEREOF the East Chicago Company has caused these presents to be executed by its Vice-President and attested by its Secretary and the corporate seal of the company to be hereto affixed, this 10th day of December A.D. 1912.

East Chicago Company,
by C. A. Weatherg,
Vice-President.

(SEAL)

Attest:
Beverly Chew, Secretary.

State of Illinois, County of Cook, ss:

I, Ruth Colman, a Notary Public in and for the County and State aforesaid, do hereby certify that C. A. Weatherg, Vice-President and Beverly Chew, Secretary of the East Chicago Company, who are personally known to me to be the same persons whose names are subscribed to the foregoing instrument, as such Vice-President and Secretary appeared before me, this day in person and acknowledged that they signed, sealed and delivered the said instrument, in writing as their free and voluntary act, and as the free and voluntary act and deed of the East Chicago Company, for the uses and purposes therein set forth, and caused the corporate seal of said Company to be thereto attached.

Given under my hand and Notarial seal, this 10th day of December A.D. 1912.

Ruth Colman,
Notary Public,

(SEAL)

My commission expires December 3rd., 1914.

Filed December 14th., 1912 at 8 A. M.

Recorder.

946(L)
846-K

"EXHIBIT A"

INTERNATIONAL SMELTING AND REFINING COMPANY

East Chicago, Indiana

Pigment Division

ANACONDA

FEDERAL TRADE COMMISSION
Docket No. 5251 Commission's Exhibit No. 846-K

June 1st, 1946

TO THE TRADE:

Our operations at East Chicago have been seriously affected by the troubles with which every concern has to contend. We refer principally to shortages of labor and supplies, higher prices for both of these, quotas which reduce volume and automatically increase production costs and restrictions on prices for finished products.

Because of these conditions operations at East Chicago have been unsatisfactory for some time. Since it appears unlikely that there will be sufficient relief reasonably soon it has been decided that operations will be discontinued permanently.

We expect to fulfill any second quarter obligations to our regular customers that we may have. All available tonnage will be distributed equitably and the regular grades will be furnished to the extent that this is possible.

We appreciate the consideration the trade has shown us during the many years we have been in business. We regret this action is necessary but feel no other course is open to us.

INTERNATIONAL SMELTING AND REFINING COMPANY

836-L

"EXHIBIT B"

INTERNATIONAL SMELTING AND REFINING COMPANY

EAST CHICAGO, INDIANA

Pigment Division

FEDERAL TRADE COMMISSION
Docket No. 5252 Commission's Exhibit No. 836-L

June 20, 1946

TO THE TRADE:

It has been decided to permanently suspend operations at the East Chicago Plant of the International Smelting and Refining Company and discontinue the business.

We appreciate the consideration the trade has shown us during the many years we have been in business. We regret this action is necessary but feel no other course is open to us.

INTERNATIONAL SMELTING AND REFINING COMPANY

341-1

M E M O R A N D U M

EAST CHICAGO PLANT OF INTERNATIONAL SMELTING AND REFINING COMPANY

At the time it was shut down in August of the current year, this plant consisted of a lead refinery, an electrolytic white lead plant and a zinc oxide plant. The lead refinery was constructed in the year 1912 in connection with the Tooele smelter. It had an initial capacity of 5,000 tons of lead per month which was later increased to 9,000 tons. For the past thirty years, it was used to refine the lead recovered from zinc plant residues at Great Falls and East Helena as well as the lead produced at Tooele. Subsequent to 1929, the quantity of lead available for the refinery declined to between 3000 and 3500 tons per month. As the result of the small intake and the steadily mounting labor costs, the cost of refining became excessive.

In the Spring of the current year, the American Smelting and Refining Company which operates a lead refinery at Omaha, Nebraska, offered us a refining contract which figured out about $5.00 per ton better than we could do. This contract was accepted and runs for a period of ten years. It covers the refining of lead produced at East Helena as well as at Tooele. The lead is returned to the Anaconda Sales Company and is guaranteed to contain less than 0.1% of bismuth which is a better grade of lead than we were able to produce with the facilities at East Chicago. The lead is returned at Omaha with transit privileges corresponding to those we had at East Chicago. Aside from the fact that the terms offered last Spring by the

process was exptected to produce a white lead of superior quality and partly beccuse it provided an additional outlet for lead in times of slack demand. There was a considereble margin between the price of lead and the price of white lead. This margin has tended to diminish and the demand for white lead has steadily decreased on account of competition from other white pigments developed during the past twenty-five or thirty years, such as lithopone and titanox. The future of white lead is now considered somewhat uncertain and since the plant is no longer needed for the recovery of bismuth, it seemed advisable to go out of the white lead business.

In 1922, it was decided to establish a zinc oxide plant at East Chicago and in 1923, a similar plant was built at Akron. These plants were justified on a basis similar to that applying to the White Lead Plant, viz, the spread between the price of zinc oxide and metallic zinc and the need for increasing our market for metallic zinc. The latter consideration was particularly important because up to about eight years ago, the contracts under which we purchased concentrates for our zinc plants, obligated us to pay for the zinc regardless of our ability to market the metal so purchased. During the past eight years most of our large zinc concentrate shippers have gone on a toll basis whereunder we treat the concentrates on agreed upon terms and return the recovered metal to the shipper. This type of contract has relieved us of what formerly was a considerable market risk and since so much of our zinc business is now

RCM 791

on this basis, we do not need the outlet provided by the zinc oxide plant. In fact, our own zinc is at times scarcely sufficient to provide the needs of the Brass Plants. For the past year or two, the oxide plant has been operating at a very reduced scale on secondary zinc metal, the supply of which is uncertain and fluctuates between wide limits. For these reasons, it was considered advisable to drop out of the zinc oxide business.

We were fortunate in being able to dispose of the East Chicago plant at a price of about $1,000,000 to the Eagle Picher Company. They propose to use it for the treatment of secondary lead, such as battery plates, and the production of zinc oxide from secondary metal and ores produced from some of their mines. They may continue the operation of the White Lead Plant. They are in the pigment business on a considerable scale and the plant is well adapted to their purposes and is well located. For various reasons, they decided to close down a plant they had in Cincinnati about the time we decided to discontinue operations at East Chicago. The acquisition of the plant by Eagle Picher seems like a logical step. In addition to the money which we received for the plant and adjacent unoccupied land, the discontinuance of our operations released approximately two and one-half million dollars tied up in warehouse and process inventories. Thus, the transaction made available to Anaconda for other purposes approximately three and one-half million dollars. Savings in lead refining costs may be estimated at $200,000 per year. The best that could be said for our white lead and zinc oxide

operations is that on a consolidated basis they broke even.

FL/FW
October 23, 1946

C O P Y

September 20, 1946.

Mr. J. R. Hobbins, President
Anaconda Copper Mining Company
B u i l d i n g.

Dear Mr. Hobbins:

You will be interested in the latest summary of the situation as it pertains to the offer Eagle-Picher has made for the East Chicago Plant.

Below I am showing Eagle's definite proposals as they now stand:

1)	Cash payment for plant and equipment as covered by Mr. Jurden's appraisal, including 37.1 acres of land	$ 800,000.00
2)	Material and Supplies	36,676.18
3)	Storeroom Supplies	79,950.12
4)	Items that were made especially for the East Chicago Plant and for which so far we have found no market .	5,000.00
	TOTAL . . .	$ 921,626.30

In addition to the above, there is a good possibility that Eagle may buy the following as indicated:

5)	Lead and zinc bearing materials, including the approximately 22% lead and 4% antimony slag	$ 60,000.00
6)	Items on order not yet delivered, estimated fair value	10,000.00
	TOTAL	$ 70,000.00

In addition to the above, we can reasonably expect to derive some additional revenue, either indirectly because of the purchase of the plant by Eagle or by direct sale to other parties.

7)	25.7 acres of land	$ 75,000.00
8)	Pension savings if Eagle purchases our property . . .	35,000.00
9)	Free storage for private car ANACONDA three years . .	10,000.00
10)	Payment for power line easement	4,000.00
	TOTAL . .	$ 124,000.00
	GRAND TOTAL . .	$1,115,626.30

A few comments concerning some of the items above may help to clarify the situation.

Item 4) This $5,000.00 sum would include such items as carborundum retorts made especially to fit our French furnaces, special sized silver room bottles, one old and one new refinery kettle whose dimensions only fit our refinery, and some carborundum and clay mixed that is designed for use in the construction of muffle furnaces. With the exception of the last item, Eagle, according to their present plans, would have no use for any of the items for several years, but they have agreed to pay $5,000.00 for the lot, and Mr. Johnson and I are convinced that we cannot obtain that much from the sale or salvage to others.

Item 5) The lead and zinc bearing materials, particularly the 800 tons of high lead slag, would probably only bring approximately $50,000.00 if sold to others. We undoubtedly can get $60,000.00 gross from other sources for these items, but the freight and loading charges would cut the net as indicated to about $50,000.00.

Item 6) This consists mainly of lead-in-oil cans of various sizes that have been lithographed with our trademark. These cans are being re-painted and will be classed, more or less, as second-grade items on account of the re-painting. Mr. Stolte does not have all the details, but we believe $10,000.00 is a fair price that can be recovered.

Item 7) The Wood River Oil & Refining Company are apparently very interested in the 25.7 acres of land and I have asked them $87,500.00 for the acreage. They believe this is a little high, but I am inclined to think if they buy at all they will pay that amount for it. If they do not purchase the land, there are others who will, although it is questionable whether we can realize over $3,000.00 per acre in other directions.

Item 8) The willingness of the Eagle-Picher Company to use our crews because they wish to operate the antimonial lead part of the refinery, whitelead, lead-in-oil and zinc oxide, would save us directly on two pensioners, one a five-year contract and the other on a three year approximately $35,000.00. Indirectly, the fact that they will employ most of the men over 50 who so far have been unable to find suitable jobs, will in my opinion, indicate indirect saving to us as well as a great deal of trouble trying to place these men.

Item 9) The proposal for free storage of the private car involves free rental -- the Anaconda Company to pay for heating the car shed and for any actual services performed in taking care of the car. The Traffic Department in Chicago has indicated that a minimum of $10.00 a day would be charged for storage in the shed unless we can find a suitable building in one of our Western plants that could be had free.

Mr. J. R. Hobbins September 20, 1946.

Item 10) Eagle-Picher has agreed to change the power line easement from a location parallel and adjacent to the canal to one parallel to the tracks on the east side of the plant. Northern Indiana have agreed to pay us $4,000.00 for the easement and the papers are now being prepared.

You understand, of course, that taxes will be prorated according to the date the property is transferred to Eagle. On insurance, all of us so far who have discussed the matter believe that it would be best for us to pay the premium on the insurance which we carry up to the day we transfer title and for Eagle to take out their own insurance according to their own ideas, starting the date they take over the plant.

Yours very truly,

F.O.Case:Mc

cc - Mr. W. H. Hoover
Mr. F. Laist

ANACONDA COPPER MINING COMPANY

25 Broadway, New York

September 30, 1946

Mr. C. E. Moran, Secretary
Anaconda Copper Mining Company
B u i l d i n g

Dear Mr. Moran:

Attached you will find an original copy of a contract between the International Smelting and Refining Company and the Eagle-Picher Company covering their purchase of the East Chicago, Indiana Plant. This has been executed by both parties and as far as our files are concerned can be considered the main and original contract.

A copy of the contract also signed is going to Mr. Laist for his files.

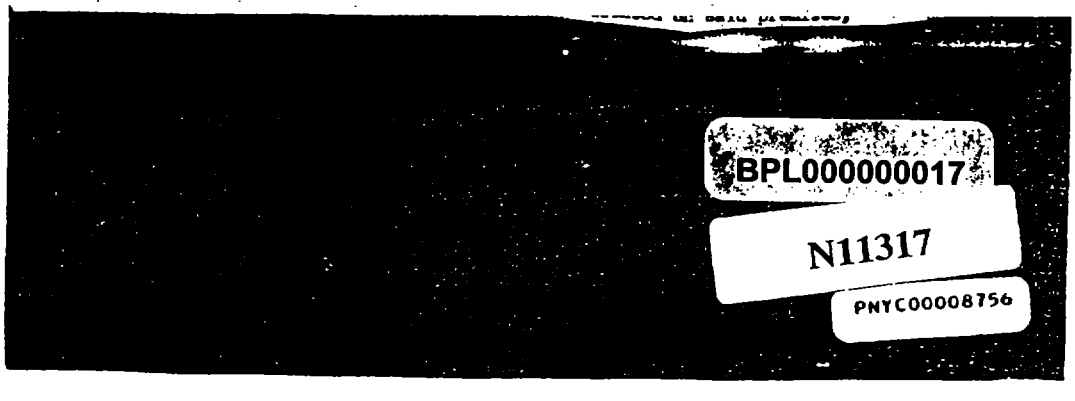
COPY

Yours very truly,

F.O.Case:Mc

cc - Mr. F. Laist

enc.



CONTRACT OF SALE

THIS AGREEMENT made and entered into this 27th day of September, 1946, by and between INTERNATIONAL SMELTING AND REFINING COMPANY, a corporation organized and existing under and by virtue of the laws of the State of Montana (hereinafter described as the "Seller"), party of the first part, and THE EAGLE-PICHER COMPANY, a corporation organized and existing under and by virtue of the laws of the State of Ohio (hereinafter described as the "Buyer"), party of the second part,

WITNESSETH:

That the Seller agrees to sell, transfer and convey, and the Buyer agrees to purchase, all of the following described property, subject to the terms and conditions as hereinafter set forth:

THAT certain tract or parcel of land on which Seller's East Chicago, Indiana, plant is located, being a fenced area of 37.101 acres, more or less, being part of that tract of land conveyed to International Smelting and Refining Company by International Lead Refining Company by deed, dated December 31, 1934, recorded in the Office of the County Clerk of Lake County, Indiana, in Book 527 at Page 191 on January 26, 1935;

TOGETHER with all the right, title and interest of the Seller in and to any land lying in the bed of any street, road or avenue, open or proposed, in front of or adjoining the above described premises to the center line thereof;

TOGETHER with all buildings and improvements thereon, and all fixtures, including, but not limited to, the boilers, cranes, heating, plumbing and lighting fixtures, and all motors, parts or accessories necessary to the use or operation of any of the same now in and about said premises, together with all furnaces, machines and machinery, appliances and equipment heretofore used by the Seller in manufacturing operations on said premises;

TOGETHER with all of the Great Falls dross, refuse oxide, high grade lead blast furnace slag, and the anolyte and catholyte solutions in the white lead plant and the white lead in the settling ditch located on said premises;

TOGETHER with all the materials and supplies now on said premises, including, but without limitation, electrical supplies, belts, janitor and safety supplies, miscellaneous storeroom supplies, pipes and valves, iron and steel shapes, brick replacement parts, items received after inventory, new supplies not on Store Books, equipment from Akron and operating supplies;

TOGETHER with those items which were made especially for the East Chicago Plant, including such items as carborundum retorts, special sized silver room bottles, refinery bottles, carborundum and clay mix for use in construction of muffle furnaces;

TOGETHER with those items now on order by the Seller for delivery at East Chicago consisting mainly of lead-in-oil cans of various sizes;

TOGETHER with an assignment to the Buyer of Seller's United States patents, numbers 2,156,420 and 2,174,559, being entitled, respectively, "Metal Vaporizing Furnaces and Processes" and "Vaporizing Furnaces and Processes for Zinc and Other Metals," together with a nonexclusive, nonassignable license to all those other patents owned by Seller covering any of its processes, methods or equipment employed in its operations at East Chicago, Indiana, prior to the shutdown of that plant on or about August 1, 1946;

except that this sale shall not include that private railroad car owned by the Anaconda Copper Mining Company, now located in a building on the premises herein conveyed.

The premises described above are sold subject to zoning regulations adopted by any city or government authority and to those agreements granting to the Indiana Harbor Belt Railroad Company rights-of-way for a water pipe, a sewer, and a switch and track entrance to said premises, and also to an easement granting to the Northern Indiana Public Service Company a right-of-way for a power line across said premises.

Seller will furnish Buyer with a deed and a full and complete abstract of title to the realty sold hereunder, the deed to be in proper form for record, and to contain the usual full warranty covenants and to be duly executed and acknowledged by the Seller at Seller's expense so as to convey to the Buyer, or its nominee, the fee simple to said realty, free of all encumbrances, except as hereinabove described.

If the Seller shall be unable to give good title, or to make conveyance as herein provided, any payments made under this Agreement shall be refunded and all other obligations of either party hereunto shall cease, but the acceptance of the deed and possession by the Buyer shall be deemed to be a full performance and discharge thereof.

The purchase price is the sum of Nine Hundred Eighty-Eight Thousand Dollars ($988,000.00), except as this amount may be revised by mutual agreement between the parties hereto to cover any adjustments following the completion of an inventory of the materials and supplies included herein, which amount is to be paid as follows:

(a) Five Hundred Thousand Dollars ($500,000.00) on the signing of this contract, the receipt of which is hereby acknowledged.

(b) Four Hundred Seventy-Five Thousand Dollars ($475,000.00) to be deposited on the signing of this contract, along with a copy of this Agreement, in the Guaranty Trust Company at New York, New York, to be paid over to the Seller upon the delivery to and acceptance by the Buyer of a deed and abstract of title covering the realty included in this transaction.

(c) The balance of the purchase price shall be paid in cash by the Buyer to the Seller on or before the delivery and acceptance of said deed.

Water rates, power bills, real estate and personal property taxes will be apportioned as of October 1, 1926.

Fire insurance on the buildings on said premises now in effect shall be maintained by the Seller until the closing of title hereunder, and in case of any loss, all sums recovered or recoverable on account of said insurance shall be paid over or assigned on delivery of the deed to

ACM 7 27

the Buyer unless the premises shall previously have been restored to their former condition by Seller.

It is agreed that the Buyer will take possession of the property on or before October 1, 1946, but that it will permit the Seller to continue to occupy certain office space and to use the plant laboratory for such period as may be necessary to close up its offices and affairs in East Chicago.

Seller agrees to execute, or cause to be executed, such other and further proper and reasonable instruments of transfer as may be required for the purpose of carrying out the intent and provisions of this Agreement.

This Agreement shall be binding upon the successors and assigns of the parties hereto.

IN WITNESS THEREOF, the parties hereto have caused their corporate names to be signed hereto and seals affixed by their officers in their behalf, all duly authorized the day and year first above written.

Witness:

Secretary

INTERNATIONAL SMELTING AND REFINING COMPANY

By _____
Vice President

Attest:

Secretary

THE EAGLE-PICHER COMPANY

By _____
President

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PAYCOC008760

BPL000000021

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>
> TOGETHER with all the right, title and interest of the Seller in and to any land lying in the bed of any street, road or avenue, open or proposed, in front of or adjoining the above described premises to the center line thereof;
>
> TOGETHER with all buildings and improvements thereon, and all fixtures, including, but not limited to, the boilers, cranes, heating, plumbing and lighting fixtures, and all motors, parts or accessories necessary to the use or operation of any of the same now in and about said premises, together with all furnaces, machines and machinery, appliances and equipment heretofore used by the Seller in manufacturing operations on said premises;
>
> TOGETHER with all of the Great Falls dross, refuse oxide, high grade lead blast furnace slag, and the anolyte and catholyte solutions in the white lead plant and the white lead in the settling ditch located on said premises;

TOGETHER with all the materials and supplies now on said premises, including, but without limitation, electrical supplies, belts, janitor and safety supplies, miscellaneous storeroom supplies, pipes and valves, iron and steel shapes, brick replacement parts, items received after inventory, new supplies not on Store Books, equipment from Akron and operating supplies;

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Seller will furnish Buyer with a deed and a full and complete abstract of title to the realty sold hereunder, the deed to be in proper form for record, and to contain the usual full warranty covenants and to be duly executed and acknowledged by the Seller at Seller's expense so as to convey to the Buyer, or its nominee, the fee simple to said realty, free of all encumbrances, except as hereinabove described.

If the Seller shall be unable to give good title, or to make conveyance as herein provided, any payments made under this Agreement shall be refunded and all other obligations of either party hereunto shall cease, but the acceptance of the deed and possession by the Buyer shall be deemed to be a full performance and discharge thereof.

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the Buyer unless the premises shall previously have been restored to their former condition by Seller.

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Seller agrees to execute, or cause to be executed, such other and further proper and reasonable instruments of transfer as may be required for the purpose of carrying out the intent and provisions of this Agreement.

This Agreement shall be binding upon the successors and assigns of the parties hereto.

IN WITNESS WHEREOF, the parties hereto have caused their corporate names to be signed hereto and seals affixed by their officers in their behalf, all duly authorized the day and year first above written.

INTERNATIONAL SMELTING AND REFINING COMPANY

Witness:

/s/ C. E. Moran
Secretary

By /s/ Frederick Laist
Vice President

Attest:

THE EAGLE-PICHER COMPANY

_____
Secretary

By /s/ J. M. Bowlby
President

1920-1-15

INTERNATIONAL SMELTING AND REFINING COMPANY

East Chicago, Indiana

November 7, 1946

TO The Eagle-Picher Company
American Building
Cincinnati, Ohio

Summary of items covered in the sale of land, improvements and operating supplies per Contract of Sale dated September 27th, 1946.

1 - Land and Improvements		$ 799,068.80
2 - Storeroom Supplies Lists 1 - 11 Incl.		81,400.90
3 - Operating Supplies - List 12		34,769.88
4 - Retorts, Bags, etc. - Exhibit "A"		5,000.00
5 - Dross, Refuse Oxide and Slag - Exhibit "B"		54,508.19
6 - Containers - Exhibit "C"		8,475.70
7 - Solutions - Exhibit "D"		711.08
8 - Dirty White Lead - Exhibit "E"		1,181.47
Fairbanks Scale - Exhibit "F"		1,183.45
Taxes - Exhibit "G"		3,700.53
TOTAL		990,000.00
Payments:		
At time of signing contract	$ 500,000.00	
On Deposit - Guaranty Trust Company, New York	475,000.00	975,000.00
		$ 15,000.00

OPERATING SUPPLIES

LIST 12

	INVENTORY AND TRIAL BALANCE OCTOBER 1ST, 1946	
ZINC OXIDE DEPARTMENT		
Fuel Oil	4,805 Gal.	$ 255.59
Hard Coal	988,915 Lbs.	3,090.35
Steel Drums	77	211.21
Muslin	9,175 Yds.	1,723.69
Duck	5,832 "	1,666.07
Barrel Liners	1,950	123.55
Fire Clay	5,000 Lbs.	37.46
Fire Brick	34,580	2,122.23
Car Lining Paper	5,000 Lbs.	167.06
		$ 9,417.21
WHITE LEAD DEPARTMENT		
Coal	150,000 Lbs.	$ 451.23
Coal (Carbon)	20,000 "	67.52
Acetic Acid	43,953 "	3,158.26
Soda Ash	34,700 "	422.18
Barrels	150	216.00
Turpentine	1,820 Lbs.	107.73
Linseed Oil	74,820 "	13,916.50
Cartons	1,412	80.09
Containers	27,841	4,383.08
		$ 22,802.59
LEAD REFINING DEPARTMENT		
Coal	30,000 Lbs.	$ 68.10
Coke	50,000 "	352.25
Sodium Nitrate	3,000 "	75.70
Limestone	155,405 "	179.87
Oil	1,100	55.00
Ganister Rock	243,100	691.62
Laboratory Supplies		461.85
Sulphur	2,262 Lbs.	37.27
Caustic Soda	10,350 "	288.87
Containers - Reels, etc. Returnable		339.56
		$ 2,550.09
		$ 34,769.88

EXHIBIT "A"

Miscellaneous Items Sold to Eagle-Picher Company

641 Carborundum Retorts

48,551 Pounds of Carborundum

39 Silver Room Retort Bottles

1 New 200-Ton Refinery Kettle

1 Old 135-Ton Refinery Kettle

Printed Paper Bags
White Lead approximately 60,000
Zinc Oxide " 12,000

(to be used for intra-plant shipments only)

Total Price for the Entire Lot as arranged with Mr. Hallows $ 5,000.00

EXHIBIT "B"

By-Products and Dross Sold to Eagle-Picher

1) Great Falls Dross

Zinc Content 412,405 Lbs.	Book Value		$ 27,979.34
	Present Day Market Value @ 6¢ per Lb.	$24,744.30	
	Deduction for Handling & Freight if sold Elsewhere	2,611.13	
	Net Sales Price		$ 22,133.17

2) Refuse Zinc Oxide

Zinc Content 486,728 Lbs.	Book Value		$ 29,203.65
	Present Market Value @ 6¢ per Lb. of Zinc	$29,203.65	
	Deduction for Handling & Freight if sold Elsewhere	3,228.63	
	Net Sales Price		$ 25,975.02

3) Lead and Antimony Slag

Estimated Tonnage - 800 Tons
Lead Content according to large sample - 4.9 Lead
1.2 Antimony

Sales Price (based on the value of recoverable lead)	$ 6,400.00
TOTAL	$ 54,508.19

EXHIBIT "C"

Sold to Eagle-Picher Company September 24, 1946

Containers at Geuder Paeschke & Frey - Milwaukee

2,153 - 50# All Purpose Kegs and Covers	$ 1,086.75
1,218 - 50# Heavy Paste " " "	686.48
2,167 - 100# " " " " "	1,255.43
3,202 - 25# All Purpose " " "	1,117.31
1,161 - 25# Heavy Paste " " "	520.06
3,937 - 12-1/2 All Purpose " " "	1,055.08
1,248 - 12-1/2 Heavy Paste " " "	458.00
	$ 6,179.11
52,062 Valve Bags for St. Regis Packer	2,296.59
	$ 8,475.70

EXHIBIT "D"

Solutions in the White Lead Plant
Sold to Eagle-Picher.

The Anolyte and Catholyte Solutions have been carefully measured and analyzed and our staff agree that their value is approximately $ 711.08.

EXHIBIT "E"

138 Barrels of Dirty White Lead

Dry Weight 31,963 Pounds - 58.19% Pb.

Calculated Settlement $ 1,181.47

EXHIBIT "F"

1 - Fairbanks Morse & Company Type S-6-20 two section Industrial Scale, including all structural steel for scale and foundation with 8' x 5' checkered steel plate platform type registering beam 30,000# x 1# and precision with distance from ℄ of beam to edge of platform (42"), on order and in process of fabrication. Price F. O. B. Chicago $ 1,183.45

EXHIBIT "G"

Taxes to cover last quarter of 1946, based on valuations filed and accepted by the Township Assessor for 1946 Taxes:

	Valuations
Improvements	$ 250,165
Personal	121,390
Land 37.123 Acres @ $ 1,441.34	53,512
Full Year	$ 425,067 @ $3.4823 = $ 14,802.11
Last Quarter	$ 3,700.53

INTERNATIONAL SMELTING AND REFINING COMPANY

MATERIAL AND SUPPLIES RECEIVED IN STOREROOM
DURING SEPTEMBER AND OCTOBER, 1946

ORDER NO.			
34573	Yale & Towne Manufacturing Company		
	1 - Hoist Motor Standard K Model		
	for use on K-30 Truck	$ 210.00	
	Express	5.01	$ 215.01
34569	Yale & Towne Manufacturing Company		
	1 - K 6720 Gem Sector 80 Teeth		
	1 - K 6723 Steering Lever		23.51
34577	General Electric Company		
	12 - 115 V Lamps		
	20 - 120 V Lamps		2.31
34734	General Electric Company		
	20 - PR 6 Bulbs		
	10 - PR 2 Bulbs		.84
15653	The Carborundum Company		
15631	137 - AT 2 Carbofrax Tile	$ 341.13	
	6 -HAT 2 "	7.66	
	138 - AT 3 "	343.62	
	4 -HAT 3 "	5.12	
	27 - KT 2 "	67.23	
	2 -HKT 2 "	2.56	
	Mould Charge	47.70	
	Freight	42.37	857.41
A-12848	Thomas Pump Company		
	2 - Foster Iron Rotary Pumps	447.12	
	Cartage	7.34	454.46
34850	Westinghouse Electric Company		
	1 - Grate Link Lock Bearings	36.26	
	Freight	1.82	38.08
33678	Chas. H. Besley & Company		
	5/12 Doz. 3" Yankee Screw Drivers		1.53
34882	Standerd Oil Company		
	303 Gal. Gasoline		57.88
34883	Linde Air Products Company		
	3 - Cylinders		5.49
34467	Montana Hardware Company		
	12 - Gas Pliers #13-7		9.78
			$ 1,566.30

INTERNATIONAL SMELTING AND REFINING COMPANY
MATERIAL AND SUPPLIES TAKEN FROM STOREROOM
DURING SEPTEMBER AND OCTOBER, 1946

REQ'N NO.		ITEM		AMOUNT
9154	10 Ft.	Rubber Asb. Covered Heater Cord	.38	
	1	Plug Cap	.14	.52
9155	7	Lamps	1.36	
	4	Mogul Std. Addapters	.93	2.29
9160	6	Lamps		.66
9159	6	"		.66
9162	2	"		.68
9163	1	"		.11
9157	3	"		3.88
9156	1	Switch		.25
9161	10 Ft.	Rubber Asb. Covered Heater Cord		.38
9164	1 Roll	Friction Tape	.18	
	1	Plug	.25	.43
9158	3	Trolley Shoes		1.20
9169	1 Qt.	Machine Enamel		.66
9149	5 Lbs.	Pax Soap		.99
9148	2 Pr.	Canvas Gloves		.34
9147	6	Flashlight Batteries		.39
9129	4 Lgths	Pipe (80')	2.80	
	1 Tank	Oxygen	1.83	4.63
9146	1 Pr.	Strap Hinges		.23
9145	5	Window Glass		.70
9142	6	Lamps		22.48
9141	6	"		.66
9140	3	"		.48
9139	1	Edwards Howler		9.18
9138	5 Lbs.	Rags		1.10
9122	1	Window Glass	.14	
	8	" "	.56	
	3 Cans	Putty	.46	1.16
9124	7	Window Glass		1.20
9123	14	" "		1.48
9134	2	Wire Brushes		.78
9135	1	" Brush		.39
9136	1	" "		.39
9137	25 Lbs.	Stanomist		3.45
9150	4	Flashlight Batteries		.26
9143	2	Rubber Sockets	.78	
	1 Case	Glass Jars	.50	1.28
9068	2 Pr.	Canvas Gloves		.34
9069	2 "	" "		.34
9153	1 "	" "	.17	
	1 "	Leather Faced Gloves	.51	.68
9083	1 Pr.	Gloves		.46
9117	2 "	Canvas Gloves		.34
9152	1 "	Gloves		.46
9170	1 "	Leather Faced Gloves		.51
9173	2	Yale Padlocks		1.22
9151	1 Pr.	Gloves		.46
	3 Tanks	Oxygen		5.49
9168	8 Gal.	Gasoline		1.49
9172	14 "	"		2.61
9167	5 "	"		.93
9174	25 "	"		4.65
9165	30 "	"		5.58

- continued -

12

MATERIAL AND SUPPLIES TAKEN FROM STOREROOM
DURING SEPTEMBER AND OCTOBER, 1946

REQ'N NO.	ITEM		AMOUNT
9171	10 Gal. Gasoline		1.86
9166	5 " "		.93
9119	20 " "		3.72
9120	8 " "		1.49
9118	8 " "		1.49
9130	1 Tank Oxygen	1.83	
	1 Doz. Hack Saw Blades	.47	2.30
9131	2 Tank Oxygen		3.66
9132	2 " "		3.66
9121	20 Gal. Gasoline		3.72
9144	20 " "		3.72
9133	1 Rotex Screener		100.00
			215.40

INTERNATIONAL SMELTING AND REFINING COMPANY
EAST CHICAGO, INDIANA

ITEMS TAKEN FROM APPRAISAL
AS OF SEPTEMBER 30TH, 1946

	SALES PRICE
Building #100 - Main Office	
2 - 8 Drawer Files	$ 24.00
1 - Electromatic Typewriter	165.00
1 - Noiseless 14" Remington Typewriter	75.00
Building #108 - Old Store Room	
1 - Ton Rubber Covered Scrap Copper Wire (Junk)	160.00
1 - Ton Scrap Copper Cable and Electrical Connections (Junk)	160.00
15 - Gals. White Paint	30.00
100 - Gals. White Paint	200.00
Building #111 - Refinery	
1 - Heppenstall Automatic Safety Tong for lifting Tooele Blocks	750.00
1 - Rotary Furnace Lining removed for salvage approx. cost new $ 1,100. was 60% used condition at time of inventory. $1,100. x 40% =	440.00
1 - Silver Room Flue partly removed but not shown on appraisal - no adjustment necessary.	
Building #206 - Sulphate	
1 - Vib. Barrel Packer with 2 H. P. Motor and starter shipped to East Helena	120.00
Building #231 - Bismuth Refinery	
16 - Bismuth Molds	24.00
Building #300 - General Laboratory	
1 - Colorimeter to Tooele	180.00
	$ 2,328.00
CREDIT	$ 931.20

10/29/46

lf

A regular meeting of the Board of Directors of the INTERNATIONAL SMELTING AND REFINING COMPANY was held at the office of the Company, No. 25 Broadway, New York, N. Y., on Tuesday, October 22, 1946, at 11:00 o'clock A. M.

PRESENT: Messrs. Cornelius F. Kelley
Frederick Laist
Robert E. Dwyer
James R. Hobbins
E. O. Sewerwine

ABSENT: Messrs. W. H. Hoover
Clyde E. Weed

The President, Mr. Cornelius F. Kelley, acted as Chairman of the Meeting and Mr. C. E. Moran, Secretary thereof.

The minutes of the regular monthly meeting of the Board of Directors held September 24, 1946 were read and, on motion duly made, seconded and adopted, were approved.

The Chairman presented to the meeting statements of Net Income and of Net Current Assets, estimated as of September 30, 1946, which on motion duly made and seconded, were approved and ordered placed on file.

On motion duly made, seconded and unanimously adopted, it was:

RESOLVED, that the action of the Officers of the Company in approving the following Appropriations be and the same is ratified, approved and confirmed:

No.	Description	Amount
480	Concrete loading platform for Baker Trucks at Perth Amboy	$19,038.00
164	Drilling a third deep well near reservoir in Pine Canyon and purchasing and installing new pump for well at Tooele Plant	8,150.00

There was presented to the meeting the contract of sale between the Company and the Eagle-Picher Company executed September 27, 1946 covering the sale and transfer to the Eagle-Picher Company of a parcel of land on which the Company's East Chicago, Indiana, Plant is located, together with all buildings and improvements thereon, all fixtures, accesseries, machines and machinery, lead and zinc bearing materials, materials and supplies, items made especially for the East Chicago Plant, items now on order by the Company and the assignment to the Eagle-Picher Company of the Company's U. S. Patents Nos. 2,156,420 and 2,174,559 for a consideration of $988,000 subject to any mutual revision upon the completion of the inventory of materials and supplies, which amount is to be paid as follows:

a. $500,000 was received from the Eagle-Picher Company upon the execution of the contract.

b. $475,000 is deposited in the Guaranty Trust Company of New York to be paid over to the Company upon the [redacted] Eagle-Picher Company of a deed and abstract of title covering the realty included in the contract of sale.

c. Balance of purchase price to be paid in cash by the Eagle-Picher Company to the Company on or before delivery and acceptance of the deed.

Water rates, power bills, real estate and personal property taxes w: apportioned as of October 1, 1946 and fire insurance on the buildings ne shall be maintained by the Company until the closing of the title.

After discussion it was on motion duly made, seconded and unanimous:

RESOLVED, that the President or Vice President and Secretary o: Assistant Secretary be and they hereby are authorized and empowered on behalf of the Company to execute and deliver to the Eagle-Picher Company a deed of the following described real estate belonging to the Company located in East Chicago, Indiana:

A part of Block thirteen (13) in the subdivision of the Southwest quarter (SW 1/4) of Section twenty-eight (28) Township thirty- seven (37) North, Range nine (9) West of the Second Principal Meridian in Lake County, Indiana, being more particularly described as follows:

Beginning at the point of intersection of the South line of Section twenty-eight (28) aforesaid with a line parallel to and thirty (30) feet West of the West line of the seventy-five (75) feet right of way of the Baltimore and Ohio Chicago Terminal Railroad Company; thence North eighty-eight (88) degrees ten and one quarter (10-1/4) minutes West a distance of six hundred twenty-two and eighty-six hundredths (622.86) feet along the South line of said section; thence North fifty (50) degrees and thirty-one (31) minutes East a distance of seven hundred four and three tenths (704.3) feet; thence North twenty-nine (29) degrees and forty-four and one-half (44-1/2) minutes East a distance of one hundred fifty-seven and sixty-two hundredths (157.62) feet to a point in a line parallel to and thirty (30) feet West of the West line of the seventy-five (75) feet right of way of the Baltimore and Ohio Chicago Terminal Railroad Co.; thence South six hundred four and nine tenths (604.9) feet to the place of beginning.

Also part of Block four (4) in the Subdivision of part of the Northwest Quarter (N.W. 1/4) of Section thirty-three (33), Township thirty-seven (37) North, Range nine (9) west of the Second Principal Meridian, in Lake County, Indiana described as follows: Beginning at a point on the North line of Section thirty-three (33) aforesaid, one hundred (100) feet East of the Northwest corner thereof; thence East on the North line of Section thirty-three (33) aforesaid eleven hundred two and thirty- four hundredths (1102.34) feet to its intersection with a line parallel to and thirty (30) feet West of the West line of the seventy-five (75) feet right of way of the Baltimore & Ohio Chicago Terminal Railroad Company; thence South on last described line eleven-hundred twenty-one and ninety-six hundredths (1121.96) feet; thence Southwesterly on a straight line one hundred eighty and twenty-seven hundredths (180.27) feet to a point ninety (90) feet West of the last described line and on a line parallel to and forty-five (45) feet North of a line drawn from a point on the North and South center line midway between the North Quarter corner and the center of said Section thirty-three (33) West to a point on the West line of Section thirty-three (33) [redacted] and twenty [redacted] of the Northwest corner thereof; thence West on the last described line ten hundred fifteen and seventy-seven hundredths (1015.77) feet to its intersection with a line parallel to and one hundred (100) feet East of the West line of Section thirty three (33) aforesaid, and thence North on last described line twelve hundred seventy-five and fifty-six hundredths (1275.56) feet to the point of beginning.

Also the North half (N 1/2) of 151 Street (subject to the rights of the public therein) described as follows, to-wit; The South forty-five (45) feet (except the East one hundred and twenty (120) feet thereof) of Block four (4) in a subdivision of part of the Northwest quarter (N.W. 1/4) of Section thirty-three (33) Township thirty-seven (37) North, Range nine (9) West of the Second Principal Meridian, in Lake County, Indiana, containing in all the land hereby conveyed (thirty-seven and one thousand two hundred and sixty-three ten thousandths (37.1263) acres more or less.

in accordance with the contract of sale heretofore entered into between the Company and the Eagle-Picher Company on September 27, 1946 and presented to this meeting, and to execute or cause to be executed such other and further proper and reasonable instruments of transfer as may be required for the purpose of carrying out the intent and provisions of the said contract of sale.

There being no further business before the Board, on motion duly made, seconded and adopted, the meeting adjourned.

C. F. KELLEY,
Chairman.

(C.S.)

C. E. MORAN,
Secretary.

251016

WARRANTY DEED

THIS INDENTURE WITNESSETH, That INTERNATIONAL SMELTING AND REFINING COMPANY, a corporation organized under the laws of Montana and licensed to do business as a foreign corporation in the State of Indiana, conveys and warrants to THE EAGLE-PICHER COMPANY, a corporation organized under the laws of the State of Ohio and licensed to do business as a foreign corporation in the State of Indiana, for and in consideration of Ten Dollars ($10.00) the receipt whereof is hereby acknowledged, the following described Real Estate in the City of East Chicago, in Lake County in the State of Indiana, to wit:

A part of Block thirteen (13) in the subdivision of the Southwest quarter (SW 1/4) of Section twenty-eight (28) Township thirty-seven (37) North, Range nine (9) West of the Second Principal Meridian in Lake County, Indiana, being more particularly described as follows:

Beginning at the point of intersection of the South line of Section twenty-eight (28) aforesaid with a line parallel to and thirty (30) feet West of the West line of the seventy-five (75) feet right of way of the Baltimore and Ohio Chicago Terminal Railroad Company; thence North eighty-eight (88) degrees ten and one quarter (10-1/4) minutes West a distance of six hundred twenty-two and eighty-six hundredths (622.86) feet along the South line of said section; thence North fifty (50) degrees and thirty-one minutes East a distance of seven hundred four and three tenths (704.3) feet; thence North twenty-nine (29) degrees and forty-

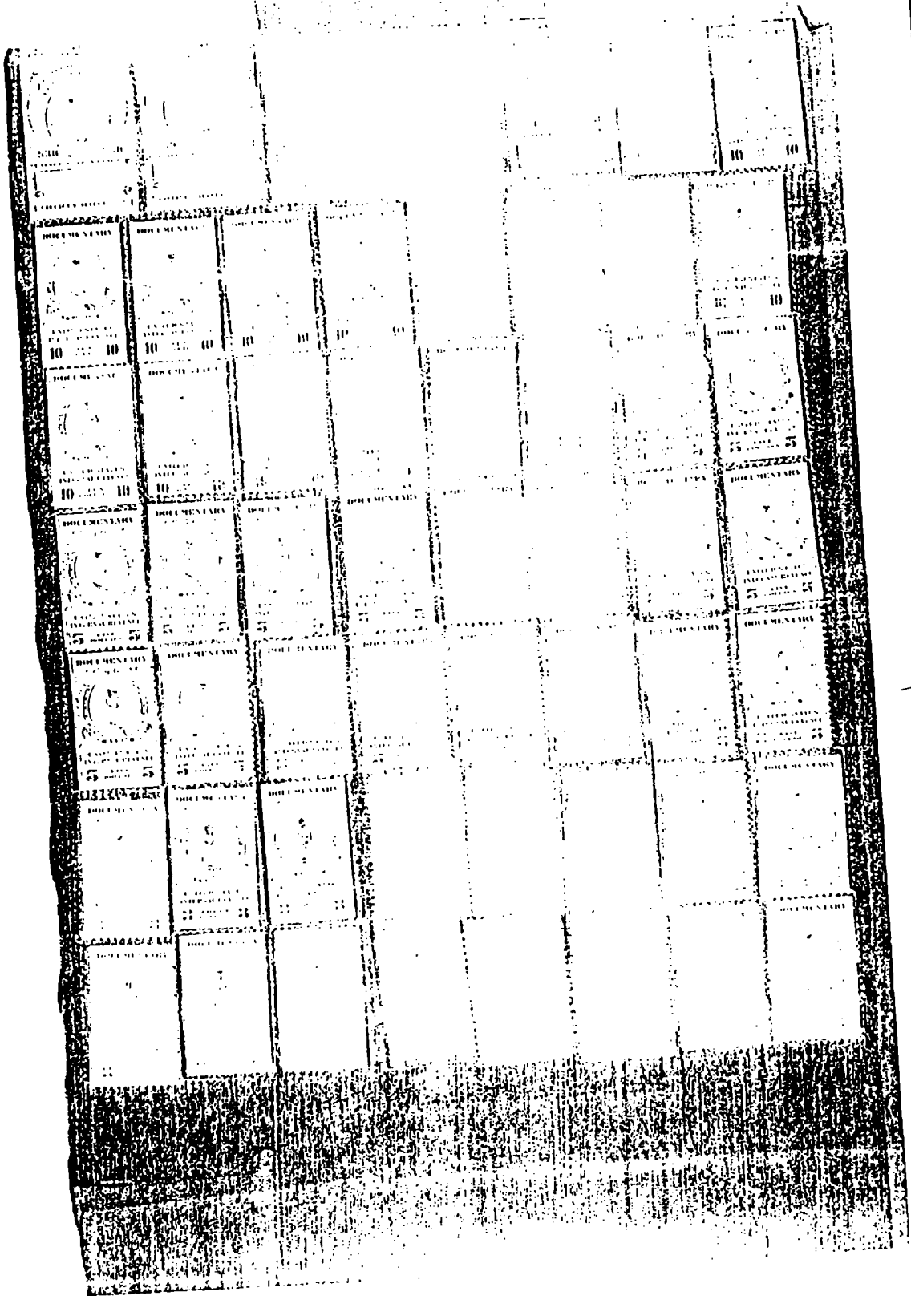
four and one-half (44-1/2) minutes East a distance of one hundred fifty-seven and sixty-two hundredths (157.62) feet to a point in a line parallel to and thirty (30) feet West of the West line of the seventy-five (75) foot right of way of the Baltimore and Ohio Chicago Terminal Railroad Company; thence South six hundred four and nine tenths (604.9) feet to the place of beginning.

Also part of Block four (4) in the subdivision of part of the Northwest Quarter (NW 1/4) of Section thirty-three (33), Township thirty-seven (37) North, Range nine (9) West of the Second Principal Meridian, in Lake County, Indiana, described as follows: Beginning at a point on the North line of Section thirty-three (33) aforesaid, one hundred (100) feet East of the Northwest corner thereof; thence East on the North line of Section thirty-three (33) aforesaid eleven hundred two and thirty-four hundredths (1102.34) feet to its intersection with a line parallel to and thirty (30) feet West of the West line of the seventy-five (75) foot right of way of the Baltimore and Ohio Chicago Terminal Railroad Company; thence South on last described line eleven-hundred twenty-one and ninety-six hundredths (1121.96) feet; thence Southwesterly on a straight line one hundred eighty and twenty-seven hundredths (180.27) feet to a point ninety (90) feet West of the last described line and on a line parallel to and forty-

five (45) feet North of a line drawn from a point on the North and South center line midway between the North quarter corner and the center of said Section thirty-three (33) West to a point on the West line of Section thirty-three (33) aforesaid, thirteen hundred and twenty (1320) feet South of the Northwest corner thereof; thence West on the last described line ten hundred fifteen and seventy-seven hundredths (1015.77) feet to its intersection with a line parallel to and one hundred (100) feet East of the West line of Section thirty-three (33) aforesaid, and thence North on last described line twelve hundred seventy-five and fifty-six hundredths (1275.56) feet to the point of beginning.

Also the North half (N 1/2) of 151st Street (subject to the rights of the public therein) described as follows, to-wit: The South forty-five (45) feet (except the East one hundred and twenty (120) feet thereof) of Block four (4) in a subdivision of part of the Northwest quarter (NW 1/4) of Section thirty-three (33) Township thirty-seven (37) North, Range nine (9) West of the Second Principal Meridian, in Lake County, Indiana, containing in all the land hereby conveyed thirty-seven and one thousand two hundred and sixty-three ten thousandths (37.1263) acres more or less.

Subject to a certain easement from the Grantor to Northern Indiana Public Service Company, a corpor-



ation, which easement is recorded in the Recorder's office of Lake County, Indiana, in Miscellaneous Record 452, at page 617.

Subject also to taxes for the year 1946 payable in 1947.

IN WITNESS WHEREOF, the Grantor has hereunto set its hand and caused its corporate seal to be affixed this 31 day of October, 1946.

INTERNATIONAL SMELTING AND REFINING COMPANY

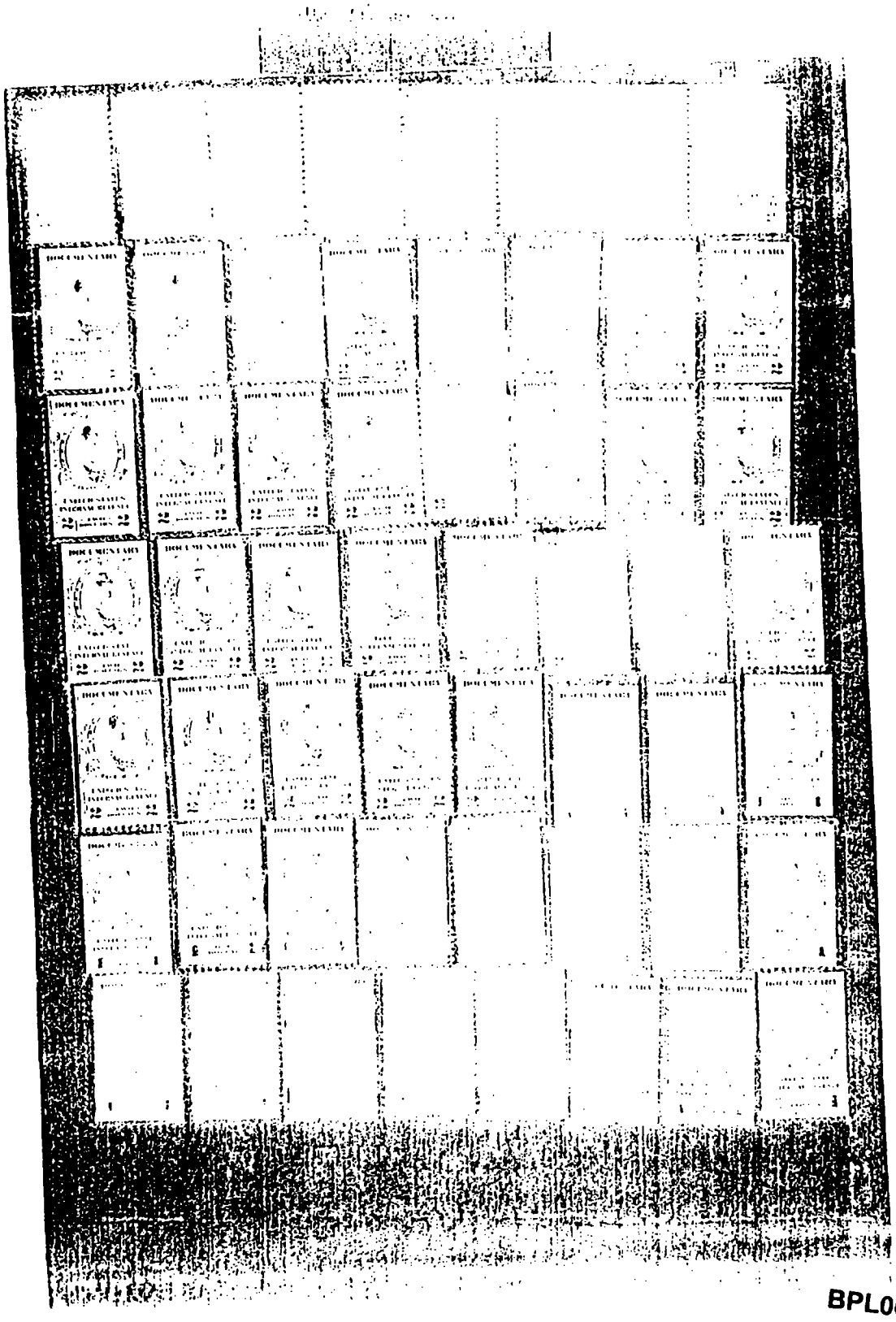
By Frederick Laist
Frederick Laist,
Vice President

W. H. Orahl
Asst. Secretary

DULY ENTERED FOR TAXATION
NOV 14 1946

STATE OF INDIANA, S.S.
LAKE COUNTY
FILED FOR RECORD
1946 NOV 9 AM 9 03

NOT TAXABLE
NOV 9 1946



A regular meeting of the Board of Directors of the INTERNATIONAL SMELTING AND REFINING COMPANY was held at the office of the Company, No. 25 Broadway, New York, N. Y., on Tuesday, November 26, 1946, at 11:00 O'clock A. M.

PRESENT: James R. Hobbins
Frederick Laist
W. H. Hoover
Clyde E. Weed
E. O. Sewerwine

ABSENT: Cornelius F. Kelley
Robert E. Dwyer

In the absence of the President, Mr. Frederick Laist, Vice President, acted as Chairman of the Meeting and Mr. C. E. Moran, Secretary thereof.

The minutes of the regular monthly meeting of the Board of Directors held October 22, 1946, were read and, on motion duly made, seconded and adopted were approved.

The Chairman presented to the meeting statements of Net Income and of Net Current Assets, estimated as of October 31, 1946, which, on motion duly made and seconded, were approved and ordered placed on file.

There was presented to the meeting a lease which had been executed on September 19, 1946, between Chief Consolidated Mining Company and this Company, covering certain lode mining claims and mining properties in Tintic Mining District, Utah and Juab Counties, Utah, containing an area of approximately 226 acres.

After discussion, it was, on motion duly made, seconded and unanimously adopted:

RESOLVED, that the action of the Officers in executing a lease, dated September 19, 1946, between the Chief Consolidated Mining Company and this Company, covering certain lode mining claims and mining properties in Tintic Mining District, Utah and Juab Counties, Utah, be and it hereby is in all respects, ratified, approved and confirmed.

There was presented to the meeting a memorandum from Mr. F. O. Case, advising that an offer had been made by Eagle-Picher Company for the purchase of ten acres of land owned by this Company at East Chicago, Indiana.

After discussion it was on motion duly made, seconded and unanimously adopted:

RESOLVED, that the offer of Thirty Five Thousand Dollars ($35,000.00) made by the Eagle-Picher Company for the purchase of ten acres of land owned by this Company at East Chicago, Indiana, be and it hereby is accepted, and

FURTHER RESOLVED, that the President or Vice President and Secretary or Assistant Secretary be and they hereby are authorized and empowered on behalf of the Company to execute and deliver to the Eagle-Picher Company a deed of the following described real estate belonging to the Company located in East Chicago, Indiana:

That part [illegible] North 269.4 feet thereof) in Block [illegible] Southwest quarter of section [illegible] 37 North, Range 9 West of the 2nd principal [illegible], in Lake County, Indiana, taken as a tract described as follows:

ACD000007739

Beginning at a point 100.0' East of the Southwest corner of said Section 28; thence North parallel to the West line of said Section 28 a distance of 415.0 feet; thence East along a line parallel to and 415.0 feet North of the South line of said Section 28, a distance of 486.21 feet; thence Northeasterly along a line which forms an angle of 221°16' 55" to the left with the last described course, for a distance of 559.76 feet to its intersection with the center

BPL000000046

line of 148th St. extended West; thence East along center line of 148th St. extended West, for a distance of 182.44 feet to a point in a line parallel to and 30.0 feet West of the West line of the 75.0 feet Right of Way of the Baltimore and Ohio Chicago Terminal Railroad Company; thence South along said line 30.0 feet West of the West line of said Railroad Company's 75 feet Right of Way, for a distance of 185.48 feet to a point 604.9 feet North of the South line of said Section 28; thence Southwesterly along a line which forms an angle of 150°14'35" to the left with the last described course, for a distance of 157.62 feet; thence Southwesterly along a line which forms an angle of 159°13'30" to the left with the last described course, a distance of 704.30 feet to a point in the South line of said Section 28; thence West along the South line of said Section 28, a distance of 478.42 feet to the place of beginning.

Subject to a certain easement from the Granter to Northern Indiana Public Service Company, a corporation, which easement is recorded in the Recorder's Office of Lake County, Indiana, in Miscellaneous Record 452, at page 617.

Subject also to taxes for the year 1946 payable in 1946.

There was presented to the meeting an Agreement, dated November 15, 1946, between the Weed River Oil and Refining Company, Inc. and this Company, under the terms of which the Weed River Oil and Refining Company, Inc., for a consideration of Two Thousand Five Hundred Dollars ($2,500.00) is given the privilege of purchasing from this Company a fifteen (15) acre tract of land, more or less, located in Lake County, State of Indiana, at a price of Sixty Seven Thousand, Five Hundred Dollars ($67,500.00) against which the amount of Two Thousand Five Hundred Dollars ($2,500.00), paid in consideration of the option, will be applied, payable:

Thirty Two Thousand Five Hundred Dollars ($32,500.00) upon notification of election to purchase and the balance of Thirty Two Thousand Five Hundred Dollars ($32,500.00) upon delivery by this Company to the Weed River Oil and Refining Company, Inc. of a Deed covering said property. The option expires after December 31, 1946.

After discussion it was on motion duly made, seconded and unanimously adopted:

RESOLVED, that the action of the Officers in executing on behalf of the Company an Agreement, dated November 15, 1946, with the Weed River Oil and Refining Company, Inc., extending an option to purchase a fifteen (15) acre tract of land, more or less, owned by this Company, situated in Lake County, State of Indiana, be and it hereby is in all respects, ratified, approved and confirmed, and

FURTHER RESOLVED, that the President or Vice President and Secretary or Assistant Secretary [illegible] and they hereby are authorized and empowered on [illegible] Oil and Refining Company, [illegible] as provided in the aforementioned Agreement, to exe-

cute and deliver to the Weed River Oil and Refining Company, Inc. a Deed of the following described real estate belonging to the Company, located in Lake County, State of Indiana:

'That part of Lot 37 (except the North 269.4 feet thereof) of Block 12 and Block 13 in the Subdivision of the Southwest quarter of Section 28, Township 37 North, Range 9, West of the 2nd principal meridian, in Lake County, Indiana, taken as a tract and described as follows: Beg. at a point 100.0 feet East of the Southwest corner of said Section 28, thence North parallel to the West line of said Section 28, a distance of 415.0 feet to a place of beginning:- thence North along a line parallel to and 100.0 feet East of the West line of said Section 28, for a distance of 747.41 feet to its intersection with the South line of the North 269.4 feet of Lot 37 of Block 12; thence East along the South line of the North 269.4' of Lot 37 for a distance of 1101.46 feet to its intersection with a line parallel to and 30.0 feet West of West line of the 75.0 feet right of way of the Baltimore and Ohio Chicago Terminal Railroad Company; thence South along said line parallel to and 30.0 feet West of West line of right of way of said Railroad a distance of 381.2 feet to its intersection with the center line of 148th St. extended West; thence West along the center line of 148th St. extended West, for a distance of 182.44 feet; thence Southwesterly along a line that forms an angle of 219° 31'45" to the left with the last described course, for a distance of 559.76 feet to its intersection with a line parallel to and 415.0 feet North of the South line of said Section 28; thence West for a distance of 486.21 feet to the place of beginning,' consisting of 15.61 acres.

There being no further business before the Board, on motion duly made, seconded and adopted, the meeting adjourned.

FREDERICK LAIST,
Chairman.

(S.)

E. MORAN,
Secretary.

WARRANTY DEED

THIS INDENTURE WITNESSETH, That INTERNATIONAL SMELTING AND REFINING COMPANY, a corporation organized under the laws of Montana and licensed to do business as a foreign corporation in the State of Indiana, Conveys and Warrants to THE EAGLE-PICHER COMPANY, a corporation organized under the laws of the State of Ohio and licensed to do business as a foreign corporation in the State of Indiana, for and in consideration of Ten Dollars ($10.00), the receipt whereof is hereby acknowledged, the following described Real Estate in the City of East Chicago, in Lake County, in the State of Indiana, to wit:

That part of Lot 37 (except the North 269.4 feet thereof) in Block 12 and Block 13 in the Subdivision of the Southwest quarter of Section 28, Township 37 North, Range 9, West of the 2nd Principal Meridian, in Lake County, Indiana, taken as a tract and described as follows:

Beginning at a point 100.0' East of Southwest corner of said Section 28; thence North parallel to the West line of said Section 28 a distance of 415.0 feet; thence East along a line parallel to and 415.0 feet North of the South line of said Section 28, a distance of 466.21 feet; thence Northeasterly along a line which forms an angle of 221°16'55" to the left with the last described course, for a distance of 559.76 feet to its intersection with the center line of 148th St. extended West; thence East along center line of 148th St. extended West, for a distance of 182.44

N11306

feet to a point in a line parallel to and 30.0 feet West of the West line of the 75.0 foot Right of Way of the Baltimore and Ohio Chicago Terminal Railroad Company; thence South along said line 30.0 feet West of the West line of said Railroad Company's 75 foot Right of Way, for a distance of 185.48 feet to a point 604.9 feet North of the South line of said Section 28; thence Southwesterly along a line which forms an angle of 150°14'35" to the left with the last described course, for a distance of 157.62 feet; thence Southwesterly along a line which forms an angle of 159°13'30" to the left with the last described course, a distance of 704.30 feet to a point in the South line of said Section 28; thence West along the South line of said Section 28, a distance of 478.42 feet to the place of beginning.

Subject to a certain easement from the Grantor to Northern Indiana Public Service Company, a corporation, which easement is recorded in the Recorder's Office of Lake County, Indiana, in Miscellaneous Record 452, at page 617.

Subject also to taxes for the year 1946 payable in 1946.

IN WITNESS WHEREOF, the Grantor has hereunto set its hand and caused its corporate seal to be affixed this ____ day of November, 1946.

INTERNATIONAL SMELTING AND REFINING COMPANY

By_____
Frederick Laist, Vice President

ATTEST:

_____
W. H. Grant, Asst. Secretary

STATE OF NEW YORK)
COUNTY OF NEW YORK) SS:

BE IT REMEMBERED that on this ____ day of November, 1946, before me, the undersigned, a notary public in and for the County and State aforesaid, duly commissioned and qualified, personally appeared Frederick Laist and W. H. Grahl, personally known to me to be the same persons whose names are subscribed to the foregoing instrument, and personally known to me to the the Vice President and Assistant Secretary, respectively, of International Smelting and Refining Company, a Montana corporation, Grantor in the above conveyance, and acknowledged that they signed, sealed and delivered said instrument as their free and voluntary act as such Vice President and Assistant Secretary, respectively, and as the free and voluntary act of said International Smelting and Refining Company, for the uses and purposes therein set forth, and said W. H. Grahl, being by me first duly sworn, deposed and said that the seal affixed to said instrument is the corporate seal of said International Smelting and Refining Company, and was by him affixed thereto in pursuance of the power and authority granted to him by resolution of the Board of Directors of said Company.

And I Do Hereby Certify that I am authorized and empowered under the laws of the State of New York to administer oaths and to take acknowledgments of the grantors making and executing deeds of conveyance.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed my notarial seal the day and year aforesaid.

Notary Public

(SEAL)

My Commission expires:

Book 770, Page 1
November 27, 1946

2.6881

THIS INDENTURE WITNESSETH, That INTERNATIONAL SMELTING AND REFINING COMPANY, a corporation organized under the laws of Montana and licensed to do business as a foreign corporation in the State of Indiana, Conveys and Warrants to THE EAGLE-PICHER COMPANY, a corporation organized under the laws of the State of Ohio and licensed to do business as a foreign corporation in the State of Indiana, for and in consideration of Ten Dollars ($10.00), the receipt whereof is hereby acknowledged, the following described Real Estate in the City of East Chicago, in Lake County, in the State of Indiana, to wit:

That part of Lot 37 (except the North 269.4 feet thereof) in Block 12 and Block 13 in the Subdivision of the Southwest quarter of Section 28, Township 37 North, Range 9, West of the 2nd Principal Meridian, in Lake County, Indiana, taken as a tract and described as follows:

Beginning at a point 100.0' East of Southwest corner of said Section 28; thence North parallel to the West line of said Section 28 a distance of 415.0 feet; thence East along a line parallel to and 415.0 feet North of the South line of said Section 28, a distance of 486.21 feet; thence Northeasterly along a line which forms an angle of 221°16'55" to the left with the last described course, for a distance of 559.76 feet to its intersection with the center line of 148th St. extended West; thence East along center line of 148th St. extended West, for a distance of 182.44

EXEMPT NO. 30-9-2 10.00A.
DULY ENTERED FOR TAXATION
DEC 26 1946
Stanley E. Olszewski
Auditor Lake County

BOOK 770 PAGE 1

BPL000000052

feet to a point in a line parallel to and 30.0 feet West of the West line of the 75.0 foot Right of Way of the Baltimore and Ohio Chicago Terminal Railroad Company; thence South along said line 30.0 feet West of the West line of said Railroad Company's 75 foot Right of Way, for a distance of 185.48 feet to a point 604.9 feet North of the South line of said Section 28; thence Southwesterly along a line which forms an angle of 150°14'35" to the left with the last described course, for a distance of 157.62 feet; thence Southwesterly along a line which forms an angle of 159°13'30" to the left with the last described course, a distance of 704.30 feet to a point in the South line of said Section 28; thence West along the South line of said Section 28, a distance of 478.42 feet to the place of beginning.

Subject to a certain easement from the Grantor to Northern Indiana Public Service Company, a corporation, which easement is recorded in the Recorder's Office of Lake County, Indiana, in Miscellaneous Record 452, at page 617.

Subject also to taxes for the year 1946 payable in 1946.

IN WITNESS WHEREOF, the Grantor has hereunto set its hand and caused its corporate seal to be affixed this 27th day of November, 1946.

INTERNATIONAL SMELTING AND REFINING COMPANY

By Frederick Laist, Vice President

STATE OF NEW YORK }
COUNTY OF NEW YORK } ss:

BE IT REMEMBERED that on this 27th day of November, 1946, before me, the undersigned, a notary public in and for the County and State aforesaid, duly commissioned and qualified, personally appeared Frederick Laist and W. H. Grahl, personally known to me to be the same persons whose names are subscribed to the foregoing instrument, and personally known to me to be the Vice President and Assistant Secretary, respectively, of International Smelting and Refining Company, a Montana corporation, Grantor in the above conveyance, and acknowledged that they signed, sealed and delivered said instrument as their free and voluntary act as such Vice President and Assistant Secretary, respectively, and as the free and voluntary act of said International Smelting and Refining Company, for the uses and purposes therein set forth, and said W. H. Grahl, being by me first duly sworn, deposed and said that the seal affixed to said instrument is the corporate seal of said International Smelting and Refining Company, and was by him affixed thereto in pursuance of the power and authority granted to him by resolution of the Board of Directors of said Company.

And I Do Hereby Certify that I am authorized and empowered under the laws of the State of New York to administer oaths and to take acknowledgments of the grantors making and executing deeds of conveyance.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed my notarial seal the day and year aforesaid.

Veronica T. Burke
Notary Public

VERONICA T. BURKE
NOTARY PUBLIC, STATE OF NEW YORK
RESIDING IN BRONX COUNTY
BRONX CO. CLK'S NO. 196, REG. NO. 14187
N.Y. CO. CLK'S NO. 199, REG. NO. 27784
COMMISSION EXPIRES MARCH 30, 1947

STATE OF INDIANA } S. S.
LAKE COUNTY }
FILED FOR RECORD

1946 DEC 12 AM 9 02

BOOK 770 PAGE 1

My Commission expires
PAUL P. KRZACIK, RECORDER

BOOK 770 PAGE 3

BPL000000054

BOOK 834 PAGE 118

Book 834, Page 118
January 5, 1949

Bamberger, Markland & Rayle
5248 Wohlman Ave.
Hmk

WARRANTY DEED

892816

THIS INDENTURE WITNESSETH, That INTERNATIONAL SMELTING AND REFINING COMPANY, a corporation organized under the laws of Montana and licensed to do business as a foreign corporation in the State of Indiana, conveys and warrants to MID-WEST TAR PRODUCTS CORPORATION, a corporation organized under the laws of the State of Indiana, for and in consideration of the sum of fifty-four thousand six hundred thirty-five Dollars ($54,635.00), the receipt whereof is hereby acknowledged, the following described real estate in the City of East Chicago, in Lake County, in the State of Indiana, to-wit:

Lot 37, excepting the north 269.4 feet and the east 30 feet thereof, in Block No. 12 and all of Block 13, except the east 30 feet thereof and excepting the lands conveyed to The Eagle-Picher Company by Deed dated October 31, 1946 and recorded November 9, 1946 in Deed Record 767 at Page 135 and by Deed dated November 27, 1946 and recorded December 12, 1946 in Deed Record 770 at Page 1, all as marked and laid down on the recorded plat of the subdivision of the S.W.1/4 of Section 28, Township 37 North, Range 9, West of the 2nd P.M. in the City of East Chicago, Lake County, Indiana, as the same appears of record in Plat Book 2 at Page 25 in the Recorder's Office of Lake County, Indiana

Subject to:

1. A certain easement from the Grantor to Northern Indiana Public Service Company, a corporation, which easement is recorded in the Recorder's Office of Lake County, Indiana, in Miscellaneous Record 452, at page 617.

K. 30-8-36
30-9-1

DULY ENTERED FOR TAXATION
MAR 28 1949
Stanley G. Olszewski
Auditor Lake County

2. A certain easement of The Eagle-Picher Company for a now existing sanitary sewer line, the course of which is described as follows: Beginning at a point on the south line of the above described tract approximately 290 feet west of the west line of the right-of-way of the Indiana Harbor Belt Railroad Company, thence northeasterly 100 feet more or less to a point in the center line of 148th Street extended, thence approximately easterly to a manhole in the center of 148th Street.

3. Taxes for the year 1948 (payable in 1949).

IN WITNESS WHEREOF, the grantor has hereunto set its hand and caused its corporate seal to be affixed this 5th day

BPL000000055

INTERNATIONAL SMELTING AND REFINING COMPANY,

By _____
Vice President (Frederick Laist)

ATTEST: _____
Secretary (C. E. Moran)

(SEAL)

STATE OF NEW YORK }
COUNTY OF NEW YORK } ss.

BE IT REMEMBERED that on this 5th day of January, 1949, before me the undersigned, a notary public in and for the County and State aforesaid, duly commissioned and qualified, personally appeared Frederick Laist and C. E. Moran, personally known to me to be the same persons whose names are subscribed to the foregoing instrument, and personally known to me to be the Vice President and Secretary, respectively, of International Smelting and Refining Company, a Montana corporation, Grantor in the above conveyance, and acknowledged that they signed, sealed and delivered said instrument as their free and voluntary act as such Vice President and Secretary, respectively, and as the free and voluntary act of said International Smelting and Refining Company, for the uses and purposes therein set forth, and said C. E. Moran, being by me first duly sworn, deposed and said that the seal affixed to said instrument is the corporate seal of said International Smelting and Refining Company, and was by him affixed thereto in pursuance of the power and authority granted to him by Resolution of the Board of Directors of said Company.

And I Do Hereby Certify that I am authorized and empowered under the laws of the State of New York to administer oaths and to

-2-

take acknowledgments of the grantors making and executing deeds of conveyance.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed my notarial seal the day and year aforesaid.

_____ Notary Public.
(Henry D. Voegtle
My Commission expires

HENRY D. VOEGTLE
NOTARY PUBLIC, STATE OF NEW YORK
Residing in Queens County
Queens Co. Clk's No. 14, Reg. No. 45-V-9
Certificate filed in
N.Y. Co. Clk's No. 84, Reg. No. 123-V-9
Commission Expires March 30, 1949

STATE OF INDIANA, S S NO.
LAKE COUNTY
FILED FOR RECORD

1949 MAR 24 AM 9 41

BPL000000056

Book 761, Page 545
March 19, 1949

392317

Bamberger, Markland & Royce
5 & 8 Hohman and Land

MORTGAGE OF REAL ESTATE.

This indenture, made this 19th day of March, 1949 between the Mid-West Tar Products Corporation, an Indiana corporation, party of the first part, hereinafter known and designated as the mortgagor, and Herman M. Mednick of Baltimore City, Maryland, party of the second part, hereinafter known and designated as the mortgagee.

WHEREAS, the said Mid-West Tar Products Corporation has borrowed from the mortgagee the sum of Thirty-one Thousand ($31,000.00) Dollars, secured to be paid by a certain note of even date herewith signed by the mortgagor payable to the mortgagee as follows:

Ten Thousand ($10,000.00) Dollars within one year from the date hereof, and the balance on or before two years from the date hereof, together with interest at the rate of six per cent per annum upon the several principal sums remaining from time to time unpaid, said interest being payable quarterly, all without any relief whatever from valuation or appraisement laws of the State of Indiana.

NOW, THEREFORE, in consideration of said loan, and for the purpose of securing payment to the mortgagee of the same and of said note, and to secure the performance of the covenants and agreements hereinafter expressed, and also in consideration of One Dollar, the receipt whereof is acknowledged, the said mortgagor does hereby mortgage and warrant unto said mortgagee, his heirs, administrators, and assigns, all the certain piece, parcel or tract of land, situated, lying and being in the City of East Chicago, County of Lake, and State of Indiana, described as follows:

761 PAGE 545

Lot No. 37 excepting the North 200.4 feet and the East 30 feet thereof in Block No. 12 and all of Block No. 13, excepting the East 30 feet thereof and excepting the lands conveyed to The Eagle-Picher Company by deed dated October 31, 1948 and recorded November 8, 1948 in Deed Record 787 at Page 135 and by deed dated November 27, 1948 and recorded December 12, 1948 in Deed Record 770 at Page 1, all as marked and laid down on the Recorded Plat of the Subdivision of the S.W. 1/4 of Section 28, Township 37 North, Range 9, West of the 2nd P.M. in the City of East Chicago of Lake County, Indiana; subject, nevertheless, to existing easements.

TOGETHER, with all and singular the tenements, hereditaments and appurtenances thereunto belonging or in any wise appertaining, and the rents, issues and profits thereof, and also all the estate, right, title interest, homestead, separate estate, possession, claim and demand whatsoever, as well in law as in equity, of the said mortgagor, Mid-West Tar Products Corporation, of, in and to the same, and every part and parcel thereof with the appurtenances.

And the said mortgagor does hereby covenant and agree to and with said mortgagee, as follows:

FIRST: That said mortgagor will pay to said mortgagee the note or obligation hereinbefore described and the indebtedness and interest evidenced thereby, and

all other sums secured hereby without relief from valuation or appraisement laws; and will keep and perform all the covenants and agreements in said note or obligation and this mortgage in manner and form as therein set out; and will pay all costs, charges, abstract fees, and all expenses of every kind and character including collection charges and attorney's fees which the mortgagee may incur in collecting any sum hereby secured, whether by foreclosure or otherwise, or in establishing the lien of this mortgage or proving the amount due thereon in any action or special proceeding of any kind or character whatsoever.

SECOND: So long as any of the indebtedness hereby secured shall remain outstanding and unpaid, the mortgagor agrees to pay all taxes and assessments levied or assessed against the same, or which may be imposed upon the mortgagee in Indiana by the reason of this mortgage investment, or upon the mortgage or obligation accompanying the same, or the debt hereby secured, and before they or any of them become delinquent; and all other debts that may become liens upon or charges against said property for repairs or improvements that are now, or that may hereafter be made thereon, and not to permit any lien to accrue and remain on said premises, or any part thereof,

THIRD: Upon the failure of the mortgagor to pay any of said taxes or assessments, or the passage by the State of Indiana of any law imposing payment of the whole or any portion of said taxes aforesaid upon the mortgagee, or upon the rendering by any Court of last resort of a decision that an undertaking by the mortgagor as herein provided to pay any taxes or assessments is legally inoperative, then and in any such event the debt hereby secured, without deduction, shall, at the option of the

mortgagee, personally due and collectible, notwithstanding anything contained in this mortgage or any law heretofore enacted or hereinafter enacted.

FOURTH: And in the event the mortgagor fails to pay the taxes or assessments which may be assessed against said real estate, or the liens or claims which may accrue thereon, the mortgagee or his heirs, administrators, or assigns, are hereby authorized at their option, but shall not be required to pay said taxes, liens, or claims, or any part thereof without said mortgagee waiving its right to foreclosure or any other right hereunder; and the mortgagor hereby agrees to refund on demand the sum or sums so paid with interest at the rate of eight per cent per annum, and this mortgage shall stand as security therefor; and any such sum or sums so paid shall become a part of the indebtedness hereby secured.

FIFTH: If the mortgagor shall fail to pay or cause to be paid any of the installments mentioned in said obligation or interest thereon according to the terms thereof, or if the mortgagor shall fail to pay said taxes or assessments as the same shall respectively become due and payable, or any other sums payable hereunder, or shall fail to perform any other act or thing herein required of or agreed by it to be done, the entire indebtedness hereby secured shall thereupon become due and payable without relief from valuation and appraisement laws of the State of Indiana, and this mortgage shall be subject to foreclosure at the option of the mortgagee without demand or notice, and the mortgagee, upon such default occurring, shall have peaceable possession of the mortgaged premises from the time

[illegible] through the [illegible] of [illegible] of re-
demption.

SIXTH: It is further agreed that all the covenants and agreements of the mortgagor herein contained shall extend to and bind its successors or assigns and shall inure to the benefit of the mortgagee, his heirs, executors, administrators, or assigns.

IN WITNESS WHEREOF, the said party of the first part has hereunto set its hand and caused its corporate seal to be affixed this 19th day of March, 1949.

Mid-West Tar Products Corporation

By Grant Thorn
President (Grant Thorp)

ATTEST:

Robert J. Baebe
Secretary (Robert J. Baebe)

(SEAL)

3 24 49

STATE OF INDIANA S.S NO.
LAKE COUNTY
FILED FOR RECORD

1949 MAR 24 AM 9 42
REC. 701 PG 545
LOUIS GRACHAN RECORDER

STATE OF MARYLAND
City
COUNTY OF BALTIMORE } SS;

Before me, the undersigned, a notary public in and for the State and City aforesaid, personally appeared Grant Thorn, President; and Robert J. Baebe, Secretary of Mid-West Tar Products Corporation, respectively, and acknowledged the execution of the above and foregoing instrument as their free and voluntary act; and the free and voluntary act of said corporation.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed my notarial seal the day and year aforesaid.

[illegible]

243910

EASEMENT FOR ELECTRICAL LINES

KNOW ALL MEN BY THESE PRESENTS: That the Grantor, INTERNATIONAL SMELTING AND REFINING COMPANY, a corporation of the State of Montana, doing business in the State of Indiana, in consideration of the sum of Four Thousand Dollars ($4,000.00), in hand paid to the Grantor, subject to certain terms and conditions hereinafter specified, hereby grants to NORTHERN INDIANA PUBLIC SERVICE COMPANY, a corporation organized under the laws of the State of Indiana, and to its successors and assigns, the right and authority to construct, erect, maintain, operate, repair, replace and renew towers and the right and authority to string, install, construct, erect, maintain, operate, repair, replace and renew wires, cables and other necessary equipment upon and between such towers and to operate by means thereof a line or lines for the transmission, distribution and delivery of electrical energy to the public in general to be used for light, heat, power, telephone and/or other similar purposes in, upon, along and over that certain parcel of real estate, situated in Sections Twenty-eight (28) and Thirty-three (33), Township Thirty-seven (37) North, Range Nine (9) West of the Second Principal Meridian, in the County of Lake, State of Indiana, described as follows:

A strip of land in the West One Half (W 1/2) of the Northwest One Quarter (NW 1/4) of Section Thirty-three (33) and in the West One Half (W 1/2) of the Southwest One Quarter (SW 1/4) of Section Twenty-eight (28), Township Thirty-seven (37) North, Range Nine (9) West of the Second Principal Meridian, said strip of land being Ninety (90) feet wide lying Forty-five (45) feet wide on each side of a center line and said center line proposed, said center line being described as follows:

Beginning at a point on the Southeasterly line of the Grantor's land, said point being (a) One Hundred

BPL000000062

Misc. Book 452, Page 617
September 25, 1946

Twelve and Five-tenths (112.5) feet Westerly of the East line of the West One Half (W 1/2) of the Northwest One Quarter (NW 1/4) of said Section Thirty-three (33) (said East line of the West One Half (W 1/2) of the Northwest One Quarter (NW 1/4) also being the center line of the right of way of the Baltimore and Ohio Chicago Terminal Railroad Company, as such right of way exists on the date hereof) measured at right angles thereto; and (B) Sixty (60) feet Northerly of the Northerly line of 151st Street in the City of East Chicago, as the same exists on the date hereof, measured along a line parallel with the East line of the West One Half (W 1/2) of the Northwest One Quarter (NW 1/4) of said Section Thirty-three (33); thence Northerly parallel with the East line of the West One Half (W 1/2) of the Northwest One Quarter (NW 1/4) of said Section Thirty-three (33) a distance of Sixty (60) feet to a point; thence Northerly a distance of Eight Hundred Forty-eight and Five-tenths (848.5) feet to a point, said point being One Hundred Twenty-seven and Five-tenths (127.5) feet Westerly of the East line of the West One Half (W 1/2) of the Northwest One Quarter (NW 1/4) of said Section Thirty-three (33), measured at right angles thereto; thence Northerly a distance of Eight Hundred (800) feet to a point, said point being One Hundred Twelve and Five-tenths (112.5) feet Westerly of the East line of the West One Half (W 1/2) of the Southwest One Quarter (SW 1/4) of said Section Twenty-eight (28), measured at right angles thereto; thence Northerly parallel with the East line of the West One Half (W 1/2) of the Southwest One Quarter (SW 1/4) of said Section Twenty-eight (28) to a point on the

SEP 24 1964

Northerly boundary line of the real estate which the Grantor owns on the date hereof (the Easterly boundary line of which real estate so owned by the Grantor being the Westerly boundary line of the right of way of the Indiana Harbor Belt Railroad Company, as the same exists on the date hereof, and the Northerly boundary line of which real estate so owned by the Grantor being the center line of the alley which, on the date hereof, is the first alley South of Vernon Street, in said City of East Chicago, as the same exists on the date hereof), the distance between said last mentioned two points being Six Hundred Sixty-five (665) feet, more or less, excepting all of the railroad right of way of the Indiana Harbor Belt Railroad, as the same exists on the date hereof; containing four and nine-tenths (4.9) acres more or less;

Subject, however, to all public highways, as the same exist on the date hereof;

This is a grant of easement only for the uses and purposes of the Grantee, as herein described. The Grantor retains the full title and ownership of the property, subject only to said easement.

The Grantor reserves the use of the above described real estate for the construction and maintenance of roadways and railway switch tracks all to the extent that such use or uses is or are not inconsistent with the terms and provisions of this grant. The Grantor also reserves the use of the above described real estate for all other uses not inconsistent with the terms and provisions of this grant.

The Grantor shall not cause or permit the construction on said real estate on or after the date hereof of any buildings, structures or facilities to be located, in whole or in part, on said real estate, which will be more than [illegible] feet in height on said real estate, above the level of said real estate as said level exists on the date

SEP 24 1946

BOOK 452 PAGE 019

hereof.

Said towers, wires, cables and line or lines including said equipment are herein collectively referred to as "said electric line or lines."

The Grantee's said electric line or lines as constructed, installed or erected shall be composed, as to its means of support, of steel towers. Said steel towers shall be placed at the approximate locations thereof as shown on Exhibit "A", hereto attached, and by this reference thereto, hereby made a part hereof. Said steel towers including foundations and footings therefor shall be placed and located within a fifty (50) foot square on said real estate, and the approximate location and the approximate center of each of which squares shall be as shown on Exhibit "A", and such steel towers may be of such type, height, size and nature, and of such capacity and may carry such number of electrical wires and/or cables of such size, type, nature and capacity, all as the Grantee may, from time to time, in its discretion and desire, choose and determine. Grantee may use said wires and/or cables for the transmission, distribution and delivery of electrical energy in such quantity or quantities, and at such voltage or voltages, and in such manner, electrically, as Grantee may, from time to time in its discretion and desire, choose and determine, but in no event shall the wires and/or cables at any point be less than 25 feet above the level of said real estate as said level exists on the date hereof.

The Grantee shall and will indemnify and save the Grantor harmless from and against any and all damages, injuries, losses, claims, demands or costs, proximately caused or resulting, solely or negligence of the Grantee, in the construction, erection, maintenance, operation, repair or removal of said electric line or lines in, upon, along and over the above described real estate.

Grantee further agrees that all property damaged

at all times, and to take such steps as may be reasonably required in accordance with good engineering practice to protect, while Grantee's work of construction is being carried on upon said real estate and also during the making at any time of any repairs and/or replacements of Grantee's said electric line or lines, all pipe lines, tracks, fences and other buildings, structures and facilities located upon said real estate, and to protect, indemnify and save Grantor harmless as against any damages or claims for damages in any manner based on or arising from damages to said pipe lines, tracks, fences and other buildings, structures, facilities and equipment or any thereof caused by the construction, installation, erection, alteration, maintenance, operation, repair, replacement, renewal or removal by Grantee of any of Grantee's facilities upon or from said real estate.

The Grantee may cut or trim trees, bushes and saplings growing upon or extending over said land so far as may be reasonably necessary in the construction, operation and maintenance of said electric line or lines.

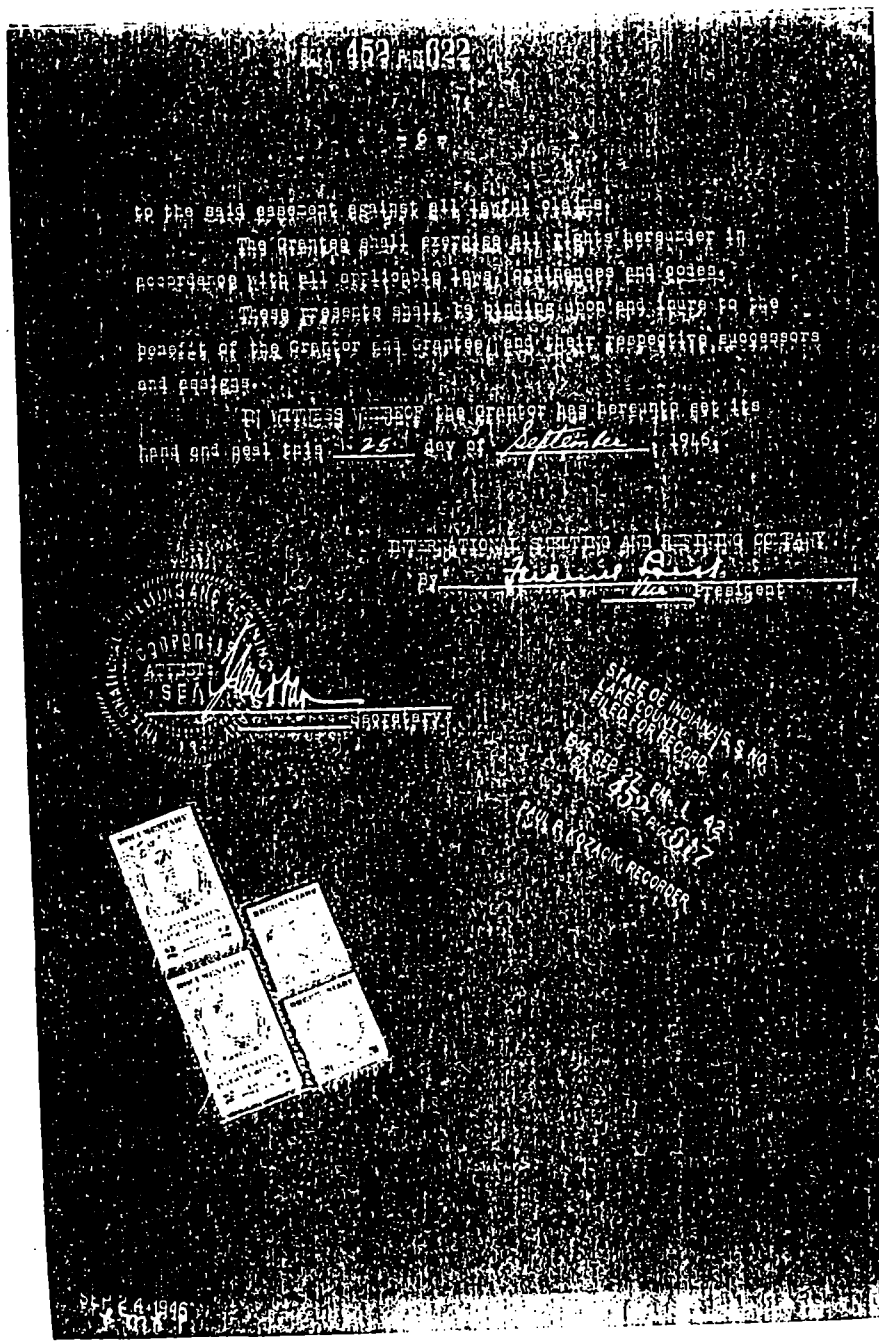
Access to the above described land over the adjoining lands of the Grantor is hereby granted, when necessary. Any use of such adjoining lands shall be in such a manner as not to interfere with the Grantor's use of the property, nor with the operation of its plant.

Grantee shall pay, before delinquency, all taxes that may be levied, charged or assessed during the existence of this easement upon any improvements and personal property owned or created by Grantee upon said real estate.

The Grantor hereby covenants that it is the owner in fee simple of said real estate; is lawfully seized thereof, and has good right to grant and convey said easement herein, and guarantee the quiet possession thereof and that said real estate is free from all encumbrances, and that the Grantor will warrant and defend the title

SEP 24 1946

452 PAGE 021



BPL000000067

RESIDENTIAL PORTION OF USS LEAD SITE
EAST CHICAGO, INDIANA

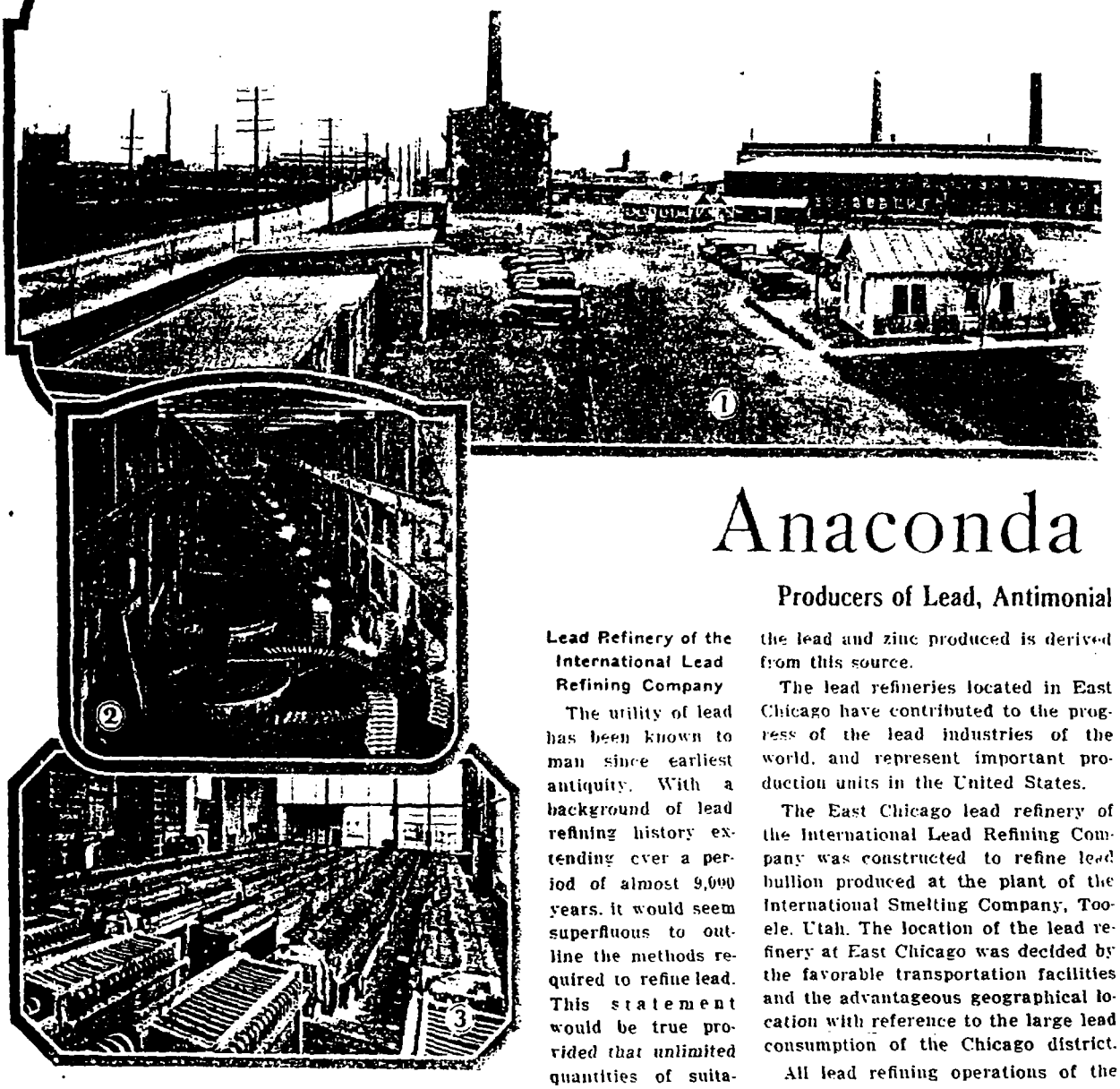
ATLANTIC RICHFIELD COMPANY

RESPONSE TO EPA'S AUGUST 15, 2005

104(E) REQUEST FOR INFORMATION

DOCUMENTS RESPONSIVE TO
QUESTIONS #7 AND 8

East Chicagoan, Vol 1, December 1930
pages 158-159, 194-195



1. General view, Anaconda Subsidiary Plants, East Chicago, Indiana.
2. Kettle Floor.
3. Electrolytic Cell Room.

Anaconda

Producers of Lead, Antimonial

The operations conducted at East Chicago by subsidiaries of the Anaconda Copper Mining Company are: lead refining, manufacture of white lead, and production of French Process zinc oxide.

The original plant built in 1912 was the lead refinery of the International Lead Refining Company; in 1919 the white lead plant was constructed by the Anaconda Lead Products Company; and in 1922 the Anaconda Zinc Oxide Department of the International Lead Refining Company constructed the zinc oxide plant.

Lead Refinery of the International Lead Refining Company

The utility of lead has been known to man since earliest antiquity. With a background of lead refining history extending over a period of almost 9,000 years, it would seem superfluous to outline the methods required to refine lead. This statement would be true provided that unlimited quantities of suitable ores were available to satisfy the ever increasing demand for the metal by modern civilization.

Modern methods for the production of lead require the most recent scientific knowledge and modern type of equipment to economically extract the metals from the known ore deposits of today.

Less than ten years ago a serious shortage of lead was predicted throughout the world, due to the rapid exhaustion of available lead ores. This challenge was accepted by the lead industry, and as a result there was developed a selective flotation process for the treatment of complex lead-zinc ores formerly considered valueless. Today a large portion of the lead and zinc produced is derived from this source.

The lead refineries located in East Chicago have contributed to the progress of the lead industries of the world, and represent important production units in the United States.

The East Chicago lead refinery of the International Lead Refining Company was constructed to refine lead bullion produced at the plant of the International Smelting Company, Tooele, Utah. The location of the lead refinery at East Chicago was decided by the favorable transportation facilities and the advantageous geographical location with reference to the large lead consumption of the Chicago district.

All lead refining operations of the entire Anaconda Copper Mining Company, in the United States, are conducted at the East Chicago Plant. While the major function of the lead refinery is to refine bullion from Tooele, Utah, it has refined large tonnages of bullion from other lead smelting plants in the United States, Canada and Mexico. New processes were developed at the plant, during the World War, for the production of antimonial lead from antimony ores. The lead bullion received contains approximately 98.5% lead; the balance consists of small amounts of impurities and precious metals, principally antimony, arsenic, copper, silver and gold.

The problem of the lead refiner is

Subsidiaries at East Chicago

Lead, French Process Zinc Oxides, Electrolytic White Lead

first to separate the impurities from the lead and then concentrate the impurities into products which can be marketed, or by-products from which the valuable metals can be recovered.

The three important products produced from the lead bullion by the refining process are: desilverized common lead, antimonial lead, and crude silver. Small quantities of copper matte are produced and returned to the copper plant of the International Smelting Company.

The lead and antimonial lead produced are widely used in industry. The major sources of consumption for lead are storage battery manufacture, lead covered telephone and power cable, white lead production, building purposes, red lead and litharge manufacture, ammunition, foil, solders, calking lead, bearing metals, castings, type-metal, and terne plate. The crude silver produced is refined and the silver and gold separated at the Raritan Copper Works, Perth Amboy, New Jersey, another subsidiary of the Anaconda Copper Mining Company.

Anaconda Zinc Oxide Department of the International Lead Refiining Company

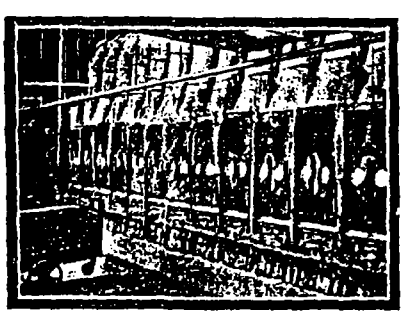
The Anaconda Zinc Oxide Department is a part of the International Lead Refining Company, a subsidiary of the Anaconda Copper Mining Company. The Zinc Oxide Department handles the production of two zinc oxide plants. One of these is located at East Chicago, Indiana, and the other responsible for the sale of the zinc at Akron, Ohio. Each plant consists of three units. This department is also oxide produced by the two plants as well as the sale of the Dry Basic Carbonate White Lead produced by the Anaconda Lead Products Company located at East Chicago, Indiana.

The zinc oxide operations of Anaconda were started in the summer of 1921, by Mr. G. S. Brooks and part of the present organization. The first work was the erection of a small pilot unit at East Chicago. When this was thoroughly tested, a commercial unit was erected and in 1923 the output of the plant was doubled. Since then minor changes have enabled us to increase the production to about double that in 1924. The Akron plant has had a similar growth and at the present time, the combined output for the two factories make the Anaconda Zinc Oxide operations the second largest in the United States. In 1926, Mr. Brooks left to take charge of Anaconda's operations in Europe and as many of his friends know, is now Vice President of the Giesche Spolka Akcyjna with headquarters at Katowice, Poland.

Zinc Oxide is a snowy white pigment, very closely resembling high grade white wheat flour used for household purposes. Commercially, zinc oxide is made by two processes. One of these is known as the "direct" process or "American" and the other the "indirect" or "French". In the American Process, the concentrated zinc ores running between 50 and 70% zinc are mixed with a reducing material such as hard coal and heated in a suitable furnace. The zinc compounds in the impure ore are reduced to metallic zinc and this zinc as vapor is volatilized and then re-oxidized by the excess air to zinc oxide. In the French Process, zinc ores are first made into metallic zinc or spelter. This may be done by a pyrometric process, where the ore is mixed with a reducing agent, charged in closed muffles and the zinc distilled off: or else it may be accomplished by means of an Electrolytic Zinc Process. The principal output of the Anaconda units consist of French Process Zinc Oxides. One American Process Block is located at Akron, Ohio.

The Metallic Zinc used to produce French Process Zinc Oxide at East Chicago and Akron is obtained from either the Anaconda or Great Falls, Montana, plants of the Anaconda Cop-

(Continued on Page 194)



Zinc Oxide Furnace

International Lead

(Continued from Page 159)

per Mining Company. This zinc is produced from zinc ores obtained throughout the west. These electrolytic zinc plants take the concentrated ores, leach them with sulphuric acid, purify the resulting solution and electrolyze in suitable cells, and thereby produce a very pure metalic zinc. This zinc is cast in the form of zinc fingers and shipped to East Chicago and Akron.

The East Chicago units produce the following grades of zinc oxide named in the order of their value and purity: U. S. P. Pharmaceutical Zinc Oxide, White Seal French Process Zinc Oxide, Green Seal French Process Zinc Oxide, Red Seal French Process Zinc Oxide, Selected Lead Free Zinc Oxide, and Lead Free Zinc Oxide.

Pharmaceutical Zinc Oxide is used principally in medicinal preparations and cosmetics. Red, Green and White Seal Zinc Oxides are used in enamels, lacquers, printing ink and surgical rubber goods. The Lead Free grades are used in interior and exterior house paints and rubber compounds.

The Zinc Oxides produced at East Chicago are distributed throughout the United States and Canada. Due to our tariff differential, exportation of zinc oxide is not always economically feasible. However, because of the quality and special properties of some of our oxides, occasional export shipments are made to even such distant points as Australia.

White Lead Plant of the Anaconda Lead Products Company

White Lead might be defined as a compound which contains lead, water and carbon dioxide in the correct proportions to make a good pigment. The value of white lead as a pigment has long been recognized. It has been stated that Cleopatra used white lead as a face powder.

The methods used for the production of white lead have in the past been predicated upon the action of moist air and carbon dioxide upon lead. Many attempts have been made without success to produce a satisfactory white lead by methods essentially different in principle than those used by the ancients.

The production of white lead by the Anaconda Lead Products Company at East Chicago is a direct application of the most modern type of process, electrochemical, for the production of one of the oldest pigments known to man, and represents perhaps the most striking development which has occurred in the white lead industry since its beginning.

An experimental plant for the production of white lead by electrolysis was constructed at East Chicago in February, 1919. The process used is the invention of Elmer A. Sperry, under whose direction the laboratory development of the process was conducted in the laboratories of the Sperry Gyroscope Company, Brooklyn, New York. It is thoroughly covered by patents in the United States.

Further development of the process to a commercial possibility resulted from the operation of the pilot plant. A commercial unit was constructed and placed in operation January, 1920.

The white lead is produced in electrolytic cells instantaneously under the accurate and scientific control made possible by the application of the principles of electrochemistry.

The lead used is delivered from the adjacent lead refinery of the International Lead Refining Company in the form of rectangular anodes. The essential operations are the production of the white lead in electrolytic cells from the lead anodes, filtration to separate the electrolyte from the white lead, drying on a mechanically operated dryer, pulverization, and barreling the product for market.

The product produced reflects the process used by its brilliant whiteness, purity, fineness, hiding and covering power, and smooth working qualities as a pigment.

The superior properties of Anaconda Electrolytic White Lead permit its use in a wide range of paints, and in many high grade products its outstanding qualities place it above competition. As a result Anaconda White Lead is shipped from East Chicago to all paint manufacturing centers in the United States. The city of East Chicago is known throughout the paint industry as the home of Anaconda White Lead.

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Gas for Industrial Use

(Continued from Page 177)

creased salability of his product, the lower overall operating cost of his plant and the improved working conditions which always result from GAS HEAT.

When treated with GAS HEAT, gears, tools and dies have a longer life, enamel ware is smoother, glassware more faultless, castings more uniform and food products tastier—for it is inherent in gas to improve everything it heats.

Industry is coming to GAS for its HEAT because it has learned to look beyond the cost of the heating process itself to the overall cost of the finished product.

Gas heat is used extensively in forging operations. Forging furnaces for end heating are shown in Illustration No. 6. Fifty per cent of the gas sold by our company in this district is used in heating steel to 2000 to 2300 degrees Fahrenheit for forging operations. Some advantages are: more uniformity of heat, less burned steel, less oxidation, less labor, greater production and less furnace repairs. The overall cost of production per unit of product is less than when a company uses cruder cheaper fuels.

When considering the purchase of many of the necessities of life what we most desire is that which will wear the longest, give us the least trouble, always be ready to go, keep us in the best of health, happy, and contented. All of this is possible when we make the right choice and pay the price on the tag—and to our surprise we find that the results justify the higher first cost of the all wool or solid gold material when compared with the cheaper part cotton or plated material.

So it is with GAS when compared with cheaper, dirty, and troublesome fuels. GAS costs more per unit of heat than many raw fuels but it is cheaper in the final analysis because it does more active work. Gas is all burned—none wasted. Gas does not freeze up—it's always on tap. Gas does not clog up burners, smear and smoke up the building—it's clean. Gas does not over heat—it's controllable. Gas requires no large, expensive supply tanks—the gas company takes care of that. You are not required to pay for gas in advance—it's paid for after it is used. These are a few of the many reasons for using what would seem at the first glance to be a high priced fuel. In the final analysis it is cheap. Gas is the only perfect fuel.

A telephone call will bring one of our industrial men to help you solve your heating problems.

Anaconda Subsidiary

Producers of Lead, Antimonial Lead, French Proces

In the operations of the International Lead Refining Company and the Anaconda Lead Products Company at East Chicago, materials originating in far distant places are brought into final marketable form and distributed. No materials of local origin enter into the product or take any essential part in the operation, other than fuel and a small amount of fluxing material. Comparatively little of the final product is consumed in local industries. Good fuel, labor and suitable fluxes are obtainable on satisfactory terms in East Chicago; however, numerous other localities could offer equal advantages in fulfilling these requirements—it is principally as a center of transportation and distribution to all parts of the United States that East Chicago is well adapted for the location of this industry.

The Anaconda Copper Mining Company's production of lead is derived from the treatment of the complex lead-copper-zinc ores of the western United States. The majority of these ores contain the three metals mentioned in the form of sulphides, and, in addition, recoverable amounts of gold and silver.

The ores are first concentrated by flotation, producing three or more products, one of which is a lead concentrate, containing the greater part of the lead and silver from the ore, with small amounts of the other metals as impurities. The complete separation of zinc and lead by concentration is difficult and a certain amount of the lead from the ore is contained in the zinc concentrate.

The lead concentrate is smelted at the plant of the International Smelting Company at Tooele, Utah, an Anaconda subsidiary. The lead and silver are recovered in the form of a "bullion" containing approximately 98 per cent lead, 60 ozs. silver per ton and small percentages of antimony and other impurities. This bullion is shipped to the International Lead Refining Company at East Chicago for refining.

The East Chicago refinery is also to some extent a custom refinery for lead bullion purchased from other sources. Lead residues and drosses from all plants of the Anaconda company are treated, and limited quantities of scrap battery plates, lead drosses, and secondary materials are purchased.

The plant is a Parkes process lead refinery of 96,000 tons' annual capacity, producing common desilverized pig lead, antimonial lead, and dore' bullion.

Three railway lines enter the plant —the Indiana Harbor Belt Railroad, the Baltimore & Ohio Chicago Terminal Railroad and the Pennsylvania Railroad.

The lead bullion produced at Tooele, Utah is molded into rectangular blocks weighing 4 tons each, loaded into open gondola cars and shipped by rail to East Chicago. At the Refinery the blocks are unloaded with tongs by an overhead crane, as shown in Figure 2, and are melted down in kettles hol... ing 135 tons of molten metal.

The antimony is separated from the lead and silver and is concentrated and placed in marketable form as an alloy with lead, known as Antimonial or "Hard" Lead. This is cast into 70 pound pigs and loaded into box cars for shipment.

The addition of antimony hardens and increases the physical strength of lead, and gives it the property of producing castings of beautiful sharpness and fidelity. Antimonial lead is used in the manufacture of storage batteries, bearing metals, type metal, ornamental novelties and a great variety of other applications.

The silver and gold are removed from the lead and, in the form of an alloy of the two metals known as dore' bullion, are shipped by express to the Raritan Copper Works at Perth Amboy, New Jersey, an Anaconda subsidiary. Here they are separated electrolytically and placed in marketable form.

The lead, freed of impurities, is cast into 96 pound pigs, loaded into box cars and shipped. Figure 3.

One of the most important applications of lead is in the production of White lead for use in paint. Here again the elements entering into the product have little to do in determining the best location for its manufacture. White lead is a basic carbonate of lead, containing lead water and carbon dioxide. No materials in any way peculiar to the Calumet Region

GENERAL VIEW, ANACONDA SUBSIDIARY

East Chicagoan, Vol 4, December 1929
pages 32-33

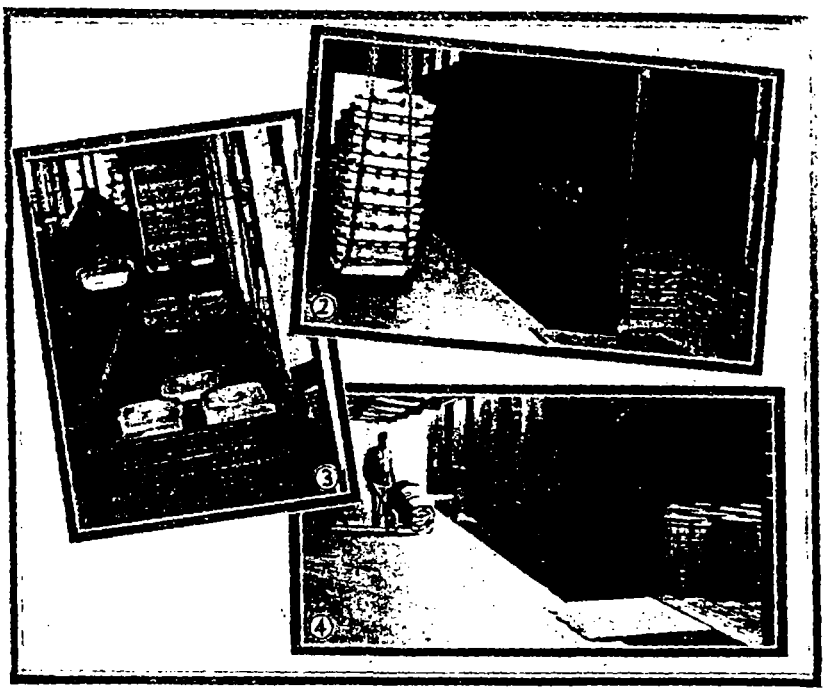
at East Chicago

Zinc Oxides, Electrolytic White Lead

enter into its production: however, the product is distributed to paint manufacturers in all parts of the United States, and in the facilities that it affords for such distribution East Chicago is pre-eminently fitted for the location of this industry.

Anaconda White Lead is an exceptionally pure white lead produced by a unique Electrochemical process developed by the Anaconda Lead Products Company at their East Chicago Plant. The process is the invention of the late Elmer A. Sperry, internationally famous as an inventor and particularly known to Chicago as the designer and donor of the Lindbergh Beacon.

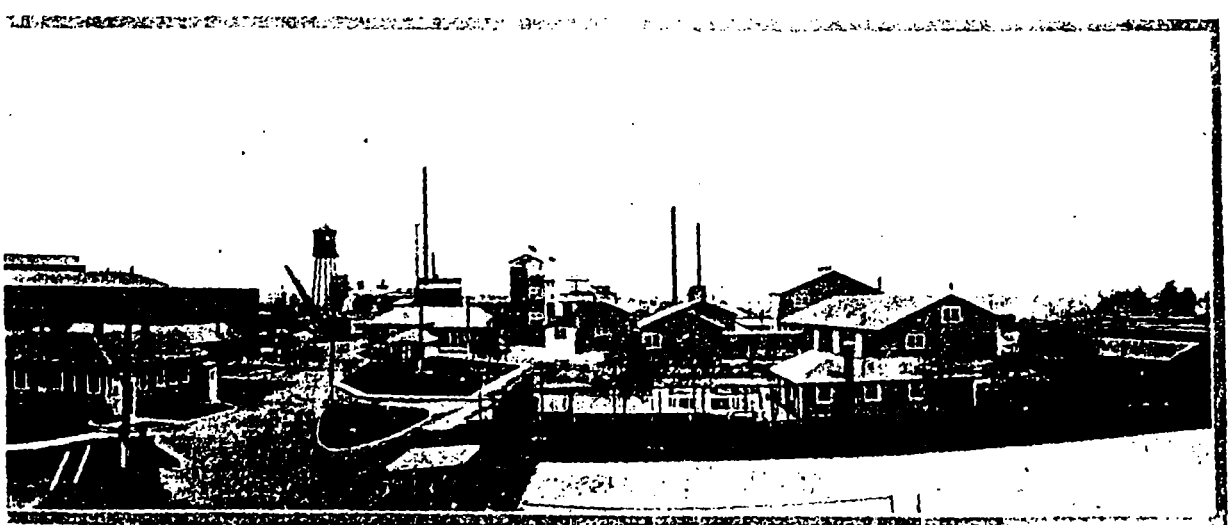
Refined lead for the white lead process is cast in rectangular anode plates at the Refinery and is delivered to the White Lead Plant by a small industrial railway joining the two plants. The anodes are placed in electrolytic cells where the lead is dissolved and converted into white lead. Though the anodes are of refined metal, the lead alone enters the white lead, which flows continuously from the cell, leaving behind even the minute amounts of other metals contained in the anode. The composition and character of the white lead are under close chemical control during its production in the cell. The white lead is next washed and dried mechanically under the same close supervision and is finally pulverized and barrelled for market. The standard package is a barrel of 600 pounds net weight. These are loaded into box cars and bound into a compact unit with steel straps to avoid damage in shipment. Figure 4.



2. Loading Pig Lead for Shipment. 3. Unloading Lead Bullion. 4. Loading Anaconda White Lead for Shipment.

The properties of Anaconda White Lead are as striking as the process which produces it. Its extreme purity and brilliant whiteness are linked with exceptional hiding and covering power and smooth working qualities.

These properties have created a wide demand for Anaconda White Lead and shipments ranging from a few pounds to many carloads are made from the East Chicago Plant. The product is valuable and easily damaged. Shipments such as those to the Pacific Coast via Atlantic ports and the Panama Canal require prompt and careful handling to avoid delay and loss. The superior transportation facilities at East Chicago are a decided advantage to both the producer and user of Anaconda White Lead.



PLANT, EAST CHICAGO, INDIANA

THE COPPER HANDBOOK

A MANUAL OF

THE COPPER MINING INDUSTRY OF THE WORLD

Founded by Horace J. Stevens.

BY

WALTER HARVEY WEED, E. M.

Former Geologist in the U. S. Geological Survey, 1883-1906. Member Institution of Mining and Metallurgy of America; Fellow Geological Society of America; Member American Institute of Mining Engineers, etc., etc.

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in Markham gulch, Bingham Canyon, Salt Lake Co., Utah. Claims said to show chalcopyrite and galena ore in vein varying from a few inches to 20′ in width, giving assays of 6.5% copper, 18.8% lead, 10 oz. silver and $2 gold per ton. The mine has 4 shafts, deepest 200′, and 8 tunnels, longest 700′, with about 3,500′ of workings. Equipment is said to include an air compressor.

INTERNATIONAL CONSOLIDATED MINING CO. — **UTAH**

Probably closed down. Letter unclaimed at Alta, Salt Lake Co., Utah. F. C. Jenkins, manager. Organized 1909, under laws of Utah, capitalization $1,000,000. Lands, 11 claims, in Big Cottonwood canyon, about 5 miles from Alta, having a 100′ tunnel showing a streak of rich sulphide ore.

INTERNATIONAL COPPER & GOLD CO. — **COLORADO, MONTANA & MEXICO**

Office: 1207 Fort Dearborn Bldg., Chicago, Ill. Organized 1899, under laws of Arizona, capitalization $3,000,000, shares $1 par. Apparently is a holding company only, controlling through stock ownership the Montana Copper & Gold Mining Co. and the Santa Fé Copper & Gold Mining Co., and in turn is controlled by Sonora Central Mines Co., under which title all affiliated properties are described.

INTERNATIONAL COPPER MINING CO. — **MONTANA**

Probably dead. Letter unclaimed at Libby, Lincoln Co., Mont. Lands, near Libby, Mont., have a short tunnel said to show an 8′ vein of molybdenite. Company was said, Jan., 1910, to be installing machinery.

INTERNATIONAL COPPER ORE CO. — **MEXICO**

Office: 424 Scarritt Bldg., Kansas City, Mo. A. M. Conard, president, Nogales, Ariz. Mine office: Noria, Sonora, Mex. Is the Mexican operating corporation of the Sonora Copper Co. Regarded with much suspicion.

INTERNATIONAL GOLD & COPPER MINING CO. — **MEXICO**

Idle. Mine office: Guaynopa, Chihuahua, Mex. J. C. Peterson, president. Company took over the lands formerly held by the International Consolidated Smelting & Mining Co. and presumably is a reorganization. Lands, 254 hectares, known as the Utah mine, in Guaynopa canyon, claimed by former owners to have a 90′ vein, with an 8 to 12″ pay streak carrying high-grade chalcopyrite, assaying 5 to 8% copper, with good silver values. Mine has several short tunnels, longest apparently only 100′. Idle on account of revolution, but regarded unfavorably for other reasons.

INTERNATIONAL METALS SELLING CO. — **UNITED STATES**

Is a subsidiary of the United States Smelting, Refining & Mining Co. and is managed by Vogelstein & Co., 42 Broadway, New York.

INTERNATIONAL MINING CO. — **MONTANA**

Office: Bozeman, Gallatin Co., Mont. J. W. Wilcox, pres.; S. J. V. B. Henderson, vice-pres. and treas.; Samuel F. Walker, sec. and gen. mgr.; preceding officers, Harvey M. Farriss and A. Badgley, directors, all of Bozeman, Mont. Organized Oct. 2, 1902, under laws of Montana; capitalization $600,000, shares $100 par, fully paid and nonassessable. Lands, 12 claims, 240 acres, well timbered, in Springhill mining district, Gallatin county, Mont., showing gneiss, quartzite and shale, said to carry fissure and contact veins, opened by 380 to 1,800′ tunnels and by 5 shafts of 80 to 800′, showing sulphide ores.

Company now developing an ore shoot said to carry 26% lead, 8 oz. silver and $8 to $67 gold per ton and expects to ship this year. The Lone Star group adjoining the International is practically under same ownership.

INTERNATIONAL NICKEL CO. — **UNITED STATES & CANADA**

General office: Constable Hook, Bayonne, N. J. Executive office: 43 Exchange Place, New York. Ambrose Monell, pres.; R. M. Thompson, chairman of board; J. L. Ashley, sec.-treas. Organized Sept. 12, 1912, succeeding International Nickel Co. and Colonial Nickel Co., the former absorbing the Canadian Copper Co., which owns the great nickel-copper mines and smelters of Sudbury, Canada. Company also absorbed the Orford Co., Anglo-American Iron Co., Vermillion Mining Co., the American Nickel Works, the Nickel Corporation of Great Britain, and the Société Minière Calédonienne.

The copper-nickel properties consist of mines with an estimated developed reserve of 20,000,000 tons, smelting plants at Copper Cliff, Canada, handling 3,500 tons daily, separating and refining plants at Constable Hook and Camden, N. J.

Capitalization $62,000,000, of which $12,000,000 is 6% preferred stock; shares $100 par; issued, 38,026,427 common and 8,904,718 preferred. Bankers Trust Co., New York, transfer agent; New York Trust Co., New York, registrar. Dividends, 6% on preferred, and 2% Dec., 1912; 2½% March 1, 1913, 3% June, 2½% September, on common stock. A majority of the stock is held by a voting trust ending Sept. 6, 1917.

INTERNATIONAL SMELTING CO. — **MEXICO**

Idle. Last address: Suaqui de Batuc, Ures, Sonora, Mex. J. V. Hammer, pres.; H. W. Tracey, sec.; C. T. Finley, treas. Organized 1905, capitalization $1,000,000, shares $1 par. Planned building a smelter, and promised dividends, but failed to carry out its promises. Is regarded with much suspicion.

INTERNATIONAL SM. & REF. CO. — **N. J., UTAH & INDIANA**

Office: 42 Broadway, New York. General manager's office: Kearns Bldg., Salt Lake City, Utah. Smelter at Tooele, Utah. Refinery at Perth Amboy, N. J. John D. Ryan, pres.; Dennis Sheedy and W. D. Thornton, vice-presidents; preceding officers, Chas. F. Brooker, Chas. N. King, Thos. Morrison, Chas. H. Sabin, Chester A. Congdon, E. C. Converse, W. E. Corey, L. D. Ricketts and Thos. F. Cole, directors; J. W. Allen, sec.-treas.; William Wraith, gen. mgr.; E. S. Woodward, ore purch. agt.; O. M. Kucks, supt. Tooele plant of International Sm. & Ref. Co. at Tooele, Utah; A. Clayton Clark, supt. Raritan Copper Works, Perth Amboy, N. J.; Geo. P. Hulst, supt. International Lead Refining Co., East Chicago, Ind.

Organized Dec. 21, 1908, under laws of New Jersey, capitalization $50,000,000, shares $100 par; issued, $10,000,000. Is controlled by the Cole-Ryan interests. Company owns the entire capital stock of the Raritan Copper Works, Raritan Terminal & Transportation Co., New Jersey Storage & Warehouse Co., Tooele Valley Railway Co., and International Lead Refining Co. Guaranty Trust Co., New York, and Old Colony Trust Co., Boston, transfer agents. Bankers Trust Co., New York, and American Trust Co., Boston, registrars. Shares are listed on the Boston Stock Exchange. Annual meeting, second Tuesday in June.

The balance sheet of Dec. 31, 1912, gave total assets of $19,387,029, of which $11,533,347 was in fixed assets and $207,358 was cash on hand and in banks. Net income for year 1912, after deducting for depreciation, was $1,106,047, compared with $1,219,037 for the preceding year and the surplus for year, $306,047.

Gross income for 1912 was $4,537,390, of which $4,423,398 was from treatment charges and profits on metals. Dividends were begun Aug. 1, 1909, on the basis of 1½% quarterly, increased 1910, to 2% quarterly.

Tooele smelter is 6½ miles from Tooele Junction on the main line

of the San Pedro, Los Angeles & Salt Lake railroad, where connection is made with the Tooele Valley railroad, and plants and yards cover one-half square mile. The receiving bins for ore, flux and fuel have 10,000 tons capacity, the ore going from bins to crushing and sampling plant by belt conveyors; the fuel to furnaces by electric tramming system.

Crushing and sampling 5-story building, 40x84', 2 complete sections using the Brunton system of sampling, contains 8 Blake type crushers, 9 to 12"x15 to 24" in size and 8 rolls, 12 to 15" wide and 26", 42" and 48" diameter. Each sampling section contains 4 Brunton sample cutters. In the copper plant the ore is crushed to three-eighths inch, conveyed from sample mill to roaster storage bins (5,000 tons capacity) by belt conveyor, thence to roaster feed hoppers by belt conveyor.

The McDougall roaster building contains 2 sections, each 64x162' and holding 32 furnaces. These furnaces are 16' in diameter, 18' high and have 6 hearths. Roaster gases pass through a 120x140' hopper bottomed brick dust chamber 30' high above hoppers, containing two 4' banks of wires; thence through brick flue 255' long to stack. The brick stack is 350' high and 25' inside diameter at the top. The reverberatory plant receives the calcine by electric tram system. It contains 5 coal-fired furnaces, Anaconda type, 1 with 19x90' hearth, 4 with 19x102' hearths. Each furnace is equipped with 750-h. p. waste-heat Stirling boiler. Gases go through a brick flue 1,360' long to stack.

The converter plant has 5 electric-driven stands for 96x150" shells and a 60-ton crane. Converter shells are lined with magnesite brick. Copper is cast in steel moulds by 30-ton crane. Slag is cast in beds and broken up and sent to the lead blast furnaces. Gases from plant go through a steel flue to a 50x126' brick bag house containing 960 31x1' 6" woolen bags. From the bag house the gas is discharged through a 150' stack 15' in diameter at the top.

The power house contains 2 Corliss engines direct-connected to 250-kw. 500-vdc. generators; 2 vertical triple-expansion engines direct-connected to 750-kva. 2,200-v. generators; 2 converter blowing engines, 15 lbs. air; 1 steam-driven 90-lb. air compressor; 1 electric-driven 90-lb. air compressor; 2 No. 10 Roots blowers, direct-connected to tandem compound Corliss engines; one 750-kw. Westinghouse-Parsons turbo-generator; and 2 Leblanc condensers and necessary auxiliaries. Condensing water is cooled in natural draft cooling tower. In addition to the waste-heat boilers, there are 3 hand-fired 350-h. p. Stirling boilers.

The lead plant contains blast furnaces, sinter plant and charge bins. There are 26 double steel bins with a capacity of 10,000 tons of ore and concentrate, receiving material from the crushing plant by belt conveyor. Fine concentrates and ores already sampled can be dumped direct. Charges for blast furnaces and sinter machines are weighed in scale hoppers and dropped into charge cars, going direct to furnaces, but sinter charges go by car to a hopper-feeding belt conveyor delivering to sintering machines.

The sinter plant contains 10 Dwight-Lloyd machines, 42x264", rated capacity 100 tons per day per machine. Sinter from machines goes to blast-furnace charge bins by standard railway cars.

The blast-furnace plant is a steel and concrete building with two 45x180" and two 60x180" furnaces whose daily capacity averages 250 tons of charge. Gases pass to brick bag house containing 1,440 bags, lead to drossing plant and the lead-copper matte to the converter plant. A slag settling furnace is being erected. The drossing plant has four 30-ton kettles and uses a Howard press.

Tooele Valley railway has 7 miles of main line; 1 locomotive, 6-wheel switching type, 57 tons weight; 1 locomotive Mogul type, 60½ tons weight; 2 locomotives, Consolidation type, 96 tons; 30 steel hopper-bottom ore cars; 3 flat cars and 4 passenger coaches.

This plant has a fully-equipped assay office and laboratory, shops, weather observation department, emergency hospital, offices, etc.

Industrial equipment consists of four 18-ton and four 12-ton electric locomotives, with necessary slag trucks, matte trucks, calcine and coal cars. All buildings are of steel and concrete construction.

The details given above show how mechanically perfect the plant has been designed. The smelting practice of copper ores largely follows Anaconda methods. The sulphide fines are roasted with a certain amount of silicious ore added upon the fifth hearth of the roasters to heat the ore and keep the temperature at the right point. The ore is roasted down to .7% sulphur corresponding to a matte fall of 15 to 18 tons per day. The reverberatory slag, carrying 40 to 42% silica, is tapped at the back of the furnace and the matte, carrying 20 to 30% copper, conveyed in ladles to the converters. The converters, when operated only on day shift, are kept hot over night by filling them with cinders from the reverberatory furnaces. Silica is applied to the converter in lump ore, 2 boats to each 8-ton charge. The bag-house dust from the smelter fumes is removed by reversing the fan and direction of current, drawing the dust into the chamber beneath.

The completion of the Utah Metal Mining Co.'s 11,000' tunnel in 1913, gives direct connection with the Bingham mines.

The Raritan plant at Perth Amboy, N. J., on New York harbor, completed 1899, and since enlarged repeatedly, is one of the largest and most modern electrolytic copper refineries in the world, employing 1,000 men and having a productive capacity at the end of 1912 of about 35,000,000 lbs. refined copper monthly.

The smelting department consists of one 200-ton, one 150-ton and one 100-ton furnaces for casting anodes, and two 225-ton, one 150-ton and two 100-ton furnaces for casting wire bars, ingots and cakes.

The electrolytic refinery includes 2 tank houses with their respective power houses, power consumption being about 7,000 kw. The department has special shears for trimming cathode sheets and Morrow loop machines for attaching copper lugs to the cathode starting-sheets.

Beginning in 1911, tank house No. 1 was entirely reconstructed, the old tanks being dismantled, copper buss bars and other equipment entirely removed and new tanks installed of a larger size, corresponding with those in No. 2 tank room. The Walker system was utilized and 200 additional tanks were installed, making 1,800 in all, which increased the capacity of the room from 13,000,000 to 22,000,000 lbs. per month. Four new electric traveling cranes were added, increasing the number to 8 cranes in all and larger buss bars were substituted of sufficient capacity to economically carry the increased current. The general arrangement and method of operation is very similar to that in No. 2 tank room. This room is 210x582'.

No. 1 power house, which furnishes power for No. 1 tank room, was also entirely remodeled, four 1,000-kw. Nordberg triple-expansion Corliss engines installed, which are expected to operate on an extremely low steam consumption. Allis-Chalmers barometric condensers were also installed. The engines are direct-connected to 1,000-kw. electrolytic generators, 2 being furnished by the General Electric Co. and 2 by the Crocker-Wheeler Co.

No. 2 tank house is 145x585', having concrete foundations, with steel frame and brick walls, special acid-proof Berlin brick being used for the basement floor. No. 2 tank house has 3 bays running lengthwise, with two

10-ton 3-motor Whiting cranes in each bay, equipped with special devices for handling an entire tankful of anodes or cathodes at 1 load. There are 3 electric circuits running lengthwise, 1 in each bay, each circuit of 396 tanks being handled from the power house by an electric generator. Current is 7,500 amperes, giving a current density of 20 amperes per sq. ft. The main conductor has a cross-sectional area of 12¼". There are 1,188 depositing tanks arranged in 108 nests of 11 cells each, with electrode arrangement on the Walker system.

The International Lead Refining Co., a subsidiary company, with an extensive plant located at 151st Street and McCook Avenue, East Chicago, Ind., has 64 acres of ground. Construction work started April 20, 1912, and plant was in operation Oct. 3, 1912. Plant comprises main refinery building 168x416', all steel and concrete, with 3 standard-gauge tracks entering the building. There are 2 crane runways running the full length of the building, with 3 traveling cranes. Brick office building is 128x36'. A men's change house, of brick, 36x70', is equipped with toilets, shower baths, steel lockers, and 1 room equipped as a dining room. Brick bag house 65' 6"x55' 10", is constructed of brick and concrete, divided into 4 compartments of 144 bags, 30'x18".

Equipment consists of one 12,000-ton battery Parkes process, two 300-ton softeners, four 60-ton desilverizing kettles, one 300-ton refining furnace, and one 200-ton molding furnace. The bullion comes in on a high track, is charged into furnace with charging machine and flows by gravity through the plant. Lead is hand-molded and trucked into cars. Sampling is done in two 40-ton kettles and bullion pumped into softeners with centrifugal pump. Residues are worked up in three 30-ton reverberatory furnaces. There are two 40-ton blast furnaces, 1 for antimonial slag, and 1 for by-products and ores; 8 retort furnaces for treating zinc skim and two 5-ton cupels for treating high-grade retort metal.

Common lead is double refined by crystallization in kettles in the corroding lead plant. Refining plant is in complete operation. All furnace gases except softeners and retorts are drawn through a sheet flue 700' long and passed through the bag house.

Power is supplied by the Northern Indiana Gas & Electric Co. Two waste-heat boilers supply steam for compressors and refinery. High-pressure air is supplied by centrifugal air compressor and air for blast furnaces is supplied by a Connersville blower. A 50,000-gal. tank elevated 50', and 100,000-gal. sump tank, waste running back into sump tank and pumped into the 50,000-gal. tank, the elevated tank being connected with the East Chicago Water Co.'s mains. Oil storage capacity, two 12,000-gal oil tanks.

The International is not burdened by old smelteries acquired at exorbitant prices, but has new and up-to-date plants, capable of handling ore as cheap, if not cheaper, than any of its competitors and is already a big factor in the mining world. It is in strong and competent hands, both technical and financial, and its profitable operation is assured.

INTERSTATE EXPLORATION CO. — ARIZONA

Office: Room 202, Endicott Bldg., St. Paul, Minn. Maj. E. L. De Lestry, manager. Property comprises copper claims near Globe, Ariz. and lead-zinc lands at Benton and Platteville, Wis., and Galena, Ill. No returns secured.

INTERSTATE SILVER-LEAD MINING CO. — IDAHO

Merged with the Callahan Mining Co. in 1912 as the Interstate-Callahan Consolidated. Is a silver-lead producer, some gray copper ore occurring in a quartz vein on the property, but not in commercial quantity. Property

gives promise of becoming one of the large lead-zinc producers of the Coeur d'Alene region.

INVESTMENT MINING & MILLING CO. — ARIZONA

O. A. Pease, pres. and gen. mgr., Goldzona, Yavapai Co., Ariz. Property, 1,400 acres, situated a few miles from Goldzona, shows veins carrying a paystreak of high-grade gold-copper ore and much low-grade ore. Development claimed in press reports to block out $500,000 worth of ore.

INYO COPPER MINES CORPORATION. — CALIFORNIA

Office: 215 Balboa Bldg., San Francisco Cal. Mine address: Keeler, Inyo Co., Cal. R. G. Paddock, pres. and gen. mgr.; F. J. O'Dea, sec. Organized Nov. 19, 1910, under laws of California, capitalization $1,000,000, shares $1 par, assessable; issued, 550,000. Levied an assessment to pay for patenting claims, 1911.

Company is a reorganization of the Inyo Copper Mines & Smelters Co. The president states that it is free of debt but is waiting for better financial conditions before attempting to raise money and that at present only a small amount of work is being done, 1913.

Property consists of 19 claims in Ubehebe district, covering a contact zone between limestone and granite porphyry. For a mile this contact is said to show places where there is 1 to 20' of ore carrying 8 to 40% copper. The steep mountain side permits development by tunnel and future work will be of this character. Former development, amounting to 650', includes 6 shallow prospect shafts and as many short tunnels, the longest 120', together with 100' of trenching. Ores carry appreciable values in gold and silver as well as copper.

INYO COPPER MINES & SMELTERS CO. — CALIFORNIA

Reorganized, 1911, as the Inyo Copper Mines Corporation, which see.

INYO COUNTY CONSOLIDATED COPPER CO. — CALIFORNIA

Idle and probably dead. Letters unclaimed at Citrus, Inyo Co., and Los Angeles, Cal. D. J. Lang, manager, at last accounts. Lands, 7 copper claims and 5 gold claims, 5 copper claims formerly owned having been sold to the New York & Inyo Copper Co.

IONE COAL & IRON CO. — CALIFORNIA

Office: 401 Crocker Bldg., San Francisco, Cal. Mine at Ione, Amador Co., Cal. A. D. Shepard, sec. and gen. mgr.; D. F. McLennan, supt. Property, 1 patented claim, on Irish hill, about 3 miles north of Ione. Is an old mine, having a lenticular orebody of chalcopyrite ore, 4' thick and 175' long, dipping at 60° and proven to a depth of 300', enclosed in greenstone. The main shaft is 450' deep with another 233' shaft and 1,988' of workings. The company modestly claims but 3,000 tons milling ore blocked out. Concentrates and high-grade ore are shipped to Mountain Copper Co. at Martinez, Cal.

Equipment includes electric light plant, two 30-h. p. hoists good for 700' depth, a 3-drill Simplex air compressor, 3-stamp mill, 50 tons capacity, in 30x90' building; 1 Blake crusher 7x9", Plndar concentrating tables, 1 Frue vanner and 1 Goulds pump.

Production for 1912 was 1,097 tons, averaging 7½% copper, yielding 164,424 lbs. copper, 18,848 oz. silver and 649 oz. gold, total value being $44,299.98.

Company plans sinking shaft No. 2 to 600' in 1913.

IOWA COPPER MINING CO. — UTAH

Probably idle. Letter unclaimed at Modena, Iron Co., Utah. L. J. Ross, manager, at last accounts. Is no relation to company of same title in Summit county, Utah. Described Vol. X.

THE MINES HANDBOOK

SUCCEEDING

THE COPPER HANDBOOK

Founded by Horace J. Stevens, 1900

DESCRIBING
THE MINING COMPANIES OF THE
TWO AMERICAN CONTINENTS

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BY
LENOX H. RAND
EDWARD B. STURGIS

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Address: Post Office Box 870, Joplin, Mo.

Officers: W. A. Ogg, pres.; H. I. Young, v. p. & gen. mgr.; G. W. Johnson, mgr.

Inc. 1908, in Maine, as a successor to the **American Zinc Ore Separating Co.** (Described in Vol. XVII.) Name changed circa 1926, to the above, to conduct mining and milling operations in Oklahoma. **Cap.** $25,000; par $5. Subsidiary of the American Zinc, Lead & Smelting Co.

Property: owns the Big Chief Mine consisting of 40 acres, one-half mile N of Picher, Okla., purchased from the S. R. & W. Mining Co., for $128,000. The mine is equipped with a 250-ton mill; it also owns and operated a mine and 300-ton mill at Douthat, Okla.

Granby Mining & Smelting Co. of Missouri

Inc. in 1864. Taken over by the American Zinc, Lead & Smelting Co. Granby M. & S. Co., of Missouri, still retains its corporate existence, but owns no real property. Described in Vol. XVII.

Included in the assets of the Granby purchase is the Granby lead smelter at Granby, Mo., which has a capacity of 24,000 tons of concentrates annually producing 18,000 tons of lead. This smelter has been idle since 1924.

Other assets still owned by American Zinc are the zinc smelter and acid plant at East St. Louis. This plant is modern in every way and has a capacity of 100,000 tons of zinc concentrates producing 50,000 tons of spelter per year. The acid plant has a capacity of 110,000 tons of 60° acid per year. In addition the company owns about 8,000 acres of undeveloped coal land in Bond county, Illinois.

Comment: American Zinc, Lead & Smelting has some valuable assets which should show favorable profits under normal conditions. Developments at Mascot have been good. Company under good management. The smelting business has been the least attractive department for several years, as the price of zinc has been low.

ANACONDA COPPER MINING COMPANY

Address: Anaconda, Mont. and 25 Broadway, New York. Annual meeting, third Wednesday in May. Transfer agents, City Bank, Farmers Trust Co., New York, Kidder, Peabody & Co., Boston, and New Jersey Corporation Agency, Jersey City. Registrars: Bankers Trust Co. of New York, National Shawmut Bank, Boston and New Jersey Title Guarantee & Trust Co., Jersey City.

Management: John D. Ryan, Chairman of the Board; Cornelius F. Kelley, pres.; Benj. B. Thayer, v. p.; Jas. R. Hobbins, v. p.; Robert E. Dwyer, v. p.; Albert H. Melin, sec.-treas.; James Dickson, gen. aud.; K. B. Frazer, asst. sec.; David B. Hennessy, asst. treas.; DIRECTORS: John D. Ryan, Percy A. Rockefeller, Cornelius F. Kelley, Benj. B. Thayer, John A. Coe, Andrew J. Miller, James R. Hobbins, Charles T. Fisher and Charles E. Mitchell.

History: Inc. June 18, 1895, under the laws of Montana as successor to the **Anaconda Mining Co.** The company's charter has a duration of forty years from date of incorporation. Together with the companies which have been consolidated with it, Anaconda for about 43 years, has occupied the position of the world's largest producer of copper and silver with also a large output of zinc, lead, gold, arsenic and other important metals, besides treating on a custom basis large quantities of ores and metals for other producers. Through acquisition of the American Brass Co., the largest factor in the world in the manufacturing and fabricating of copper and brass, Anaconda became a completely integrated organization covering every step in the copper industry, and through the acquisition of a majority of the capital stock of the Chile Copper Co. controls the most extensive as well as one of the most valuable known bodies of copper ore in the world.

All the property and assets of the following companies were acquired by Anaconda in 1910: **Boston & Montana Consol. Copper & Silver Mng. Co., Red Metal Mining Co., Washoe Copper Co., Butte & Boston Consol. Mng. Co., Big Blackfoot Lumber Co., Trenton Mng. & Develop. Co., Parrot Silver & Copper Co., Alice Gold & Silver Mng. Co., Original Consol. Mng. Co., Colusa-Parrot Mng. & Smelt. Co., and Diamond Coal Co.**

As Amalgamated Copper Co. was a large shareholder in the stocks of these companies, for a time it possessed the controlling interest in the Anaconda Copper Mining Co. In 1915, Amalgamated Copper Co. was dissolved, each shareholder receiving $50 in stock of the Anaconda Copper Mining Co. besides about $3 in cash for each $100 share of Amalgamated stock held, and the right to subscribe at $25 per share (the former par value) for one additional share of Anaconda stock for each 6 shares of Amalgamated held.

In 1914 Anaconda acquired the assets of International Smelting & Refining Co. This latter company was dissolved and the properties located in Utah and Arizona were transferred to the International Smelting Co., an Anaconda subsidiary, with the remaining assets going direct to the Anaconda Copper Mining Co. The I. S. & R. Co. owned the entire stock of the Tooele Valley Ry. Co., International Lead Refining Co. and Raritan Copper Works.

In 1915 company leased the property of **Butte Copper & Zinc Co.** (q.v.) including the Emma mine for a period of 5 years. A new lease was taken in 1916 which runs until 1931. The companies share net earnings after all expenses on a 50-50 basis. Anaconda has acquired a substantial share interest in Butte Copper & Zinc Co.

In 1916 Anaconda purchased the entire property of **Pilot Butte Mining Co.** Also owns entire capital stock of the Interstate Lumber Co., besides 99% of the capital stock of Butte Water Co., and about 87% of the capital stock of the South Butte Development Co.

Anaconda holds important interests in **Andes Copper Mng. Company** and **Andes Exploration Co.**, both organized in 1916 and hereinafter described.

Santiago Mining Co. (q.v.) was organized in 1917, in which Anaconda owns a controlling interest.

Through the Mines Investment Corp., the entire capital stock of which it holds, Anaconda owns a substantial interest in shares of **Inspiration Consolidated Copper Co.** stock.

Anaconda also owns over 95% of the shares of **Greene Cananea Copper Co.**, having added to its former holdings in 1928 and 1929, through a share exchange arrangement; one-half the stock of Arizona Oil Co., 99.9% of the capital stock of the **American Brass Co.** and over 95% of the capital stock of the **Chile Copper Co.** which see.

On October 1, 1918, International Smelting Co. exercised its option on 630,000 shares of a total 1,250,000 shares of the **Walker Mining Co.** (q.v.) Anaconda also owns all the capital stock of the Butte, Anaconda & Pacific Ry. and has assumed the bonds.

In 1924 it purchased the properties of the **Davis-Daily Copper Co.** (q.v.) for $3,000,000. In the same year, the International Smelting Co. acquired properties of the Utah Consolidated Mining Co. at foreclosure sale to satisfy a demand note representing advances to Utah Consol. to meet judgment obtained by Utah Apex Mining Co. for trespass. The property is now held by **Utah Delaware Mng. Co.** (q.v.), a subsidiary of International. Also in 1924, International acquired a controlling interest in **North Lily Mng. Co.** (q.v.) in Utah.

In 1924, the Flintkote Co. was appointed sole selling agent in the United States and Canada for Anaconda copper shingles.

In May 1926, Anaconda in association with W. A. Harriman & Co., exercised an option on the von Giesche properties containing extensive zinc ore deposits in Upper Silesia on the newly created border between East Prussia and Poland. In July 1926, the Silesian-American Corp., was organized to acquire the property. It is controlled by the Silesian Holding Co., which in turn is controlled by Anaconda.

and drying plant (finished product ¼" size), storage bins of 4000 tons capacity and box car loaders, etc. The company has erected a model mine town containing modern homes that are rented to employees at a nominal figure. About 70 men are employed and production is approximately 200 tons per day.

INTERNATIONAL SMELTING CO.

Subsidiary of the Anaconda Copper Mng. Co.

General office: 25 Broadway, New York. **Operating address:** J. O. Elton, mgr., A. B. Young, asst. mgr., 618 Kearns Bldg., Salt Lake City. J. B. Whitehill, ore purchasing agt., J. C. Welch, safety engr.

Officers: C. F. Kelley, pres.; B. B. Thayer, v. p.; A. H. Melin, treas.; D. B. Hennessy, sec'y and asst. treas.; D. M. Kelly, asst. sec'y. **Directors:** C. F. Kelley, B. B. Thayer, A. H. Melin, John D. Ryan and D. B. Hennessy.

Inc. May, 1914 in Montana. **Cap.** $15,000,000. Stock entirely owned by Anaconda Copper Mining Co. Company is a reorganization of the International Sm. & Ref. Co.

Company operates smelters at Tooele, Utah, and Miami, Ariz., also 1000 ton selective flotation concentrator at Tooele, Utah; and owns stock control of Walker Mng. Co.

The International Smelting Co., in 1926, purchased from the Empire Zinc Co., the **Potosi Lead Mine** in Yellow Pine District, 26 miles from Las Vegas, Nev.

At Rico, Colo., the International owns and operates a 250 ton flotation mill for the treatment of ores from the **Falcon Lead Mining Co.** In addition to this the mill also treats custom ores.

In the Tintic District International owns outright the **Utah Delaware Mines**, formerly the Utah Consolidated. Through its ownership in the **Park Utah Consolidated Mines Co.**, the **Ontario Silver Mng. Co.** and the **North Lily Mining Co.**, controls the largest production of the district.

During 1928 the International acquired a majority ownership of the Park Nelson Mining Co., and the Park-Premier Mining Co. The latter company holds a 5% interest in the Park Central Mining Co., Park Empire Mining Co., and the Park Cummings Mining Co., all in Park City District. These companies own collectively more than 5,000 acres of mineral land. Development of these properties is financed by International Smelting.

The Miami Smelter

Smelter address: Miami, Ariz. **Officials:** T. H. O'Brien, gen. mgr.; P. D. I. Honeyman, supt.; Wm. E. Plaisted, chief engr., power plant.

This copper smeltery built primarily to smelt the concentrates produced by Inspiration Cons. Copper Co. and the Miami Copper Co., also accepts other custom ores. The plant is situated about a mile E. of Miami and 6 miles W. of Globe, on the Inspiration Co.'s industrial railway connecting with the Arizona Eastern R. R. at Miami.

The smelter is essentially a reverberatory plant, which on account of the high copper content of the concentrates treated, has been built to minimize losses in the handling of material from one department to another, and the prevention of dust losses, as far as possible.

Material from both Miami and Inspiration mills which is flotation concentrate is hauled to the smelting plant in 60-ton steel cars especially designed to handle sticky, fine material of this nature. The smelter also treats the flotation concentrate of the Iron Cap Copper Co., and flotation concentrate, gravity concentrate and flue dust of the Old Dominion Co.

Bins: concentrates are first bedded in three 4,000-ton V-shaped bins with the necessary limestone, pyrite, first-class ore and secondaries to give a proper smelting mixture.

Crushing and Sampling Plant: 22'x40', 5 stories high, contains: 18"x30" Blake crusher; 1 set 54"x16" rolls; 3 sets 42"x16" rolls; 16" Snyder sampler; three 27 Snyder samplers; two 24"x8" rolls.

Steel storage bins of 1,500 tons capacity are provided for the storage of crushed ore and fluxing material.

Roaster and Dryer Plant: 67'x150' and 93' high, contains 10 Wedge roasting furnaces 22' 6" in diam., each having 5 regular hearths and a dryer hearth. Two oil burners on the 1st and 1 on the 6th hearth supply the heat for drying. Roasting has not been found necessary, and in some cases pyrite is added to give the proper grade of matte.

Each furnace is fed from a 190-ton storage bin directly over it. The gases pass directly to a header flue, and then into Cottrell treaters located above the charge floor, which practically prevent the loss of any flue dust.

Reverberatory Plant: this building, 134'x234', contains reverberatory furnaces, 1 with a 25x120' and 3 with 21x120' hearth areas. Total rated capacity is 875,000 tons of ore per year. The furnaces are oil fired and discharge their gases through Stirling boilers, after which they pass through a 16x16x 273' dust chamber before reaching the 275' stack. There are ten 713-h. p. and two 850-h. p. waste heat Stirling boilers.

Converter Plant: is 58'x380'x49' to the top of crane rail. Two 40-ton magnet-switch-controlled electric traveling cranes are provided.

The plant contains 5 converter stands of 12' electrically operated Great Falls type converters; 2 straight line casting machines with 5'6"x16'6" tilting furnaces, 1 skullbreaker, etc. Silica bins filled by belt conveyors discharge into weighing hoppers, which measure out a predetermined charge, delivering it directly into the mouth of the converter through pivoted spout.

The gases from the converters are passed through Cottrell treaters before being discharged into the chimney, which give a high recovery of the precious metals contained in the gases.

Power Plant: at the smelting works is operated by the Inspiration Co., the smelting plant selling its steam to, and purchasing its power from, the Inspiration company. The power plant buildings are of steel and reinforced concrete construction throughout. The main units consist of three 6,000-k. w. turbogenerators, and 4 cross-compound 15,000 cu. ft. blowing engines, switchboard, etc. Modern auxiliary apparatus is provided for condensing, automatically measuring steam and feed water, recording temperatures, pressures, etc. The boiler houses contain twelve 713-h. p. oil-fired Stirling boilers equipped with superheater and economizer.

Shops, Offices, etc.: a steel shop building, equipped with traveling crane, is divided into departments, viz., machine, blacksmith, boiler, electrical and carpenter shops, all well equipped with modern tools. The warehouse, general office and laboratory buildings, and 8 staff cottages at the smelting plant are of reinforced concrete throughout. Water for the plant is obtained from the Inspiration Co.

On account of the high copper content of the concentrates which the plant receives, it has a production capacity of 20,000,000 lbs. of copper per month, not including two spare reverberatory furnaces.

Production:

Year	Concentrate tons	*Ore tons	Copper lb	Gold oz.	Silver oz.
1929 (a).....	.....	.....	.....	....	.....
1928.....	219,401	.....	121,746,288	6,638	239,748
1927.....	237,811	.....	125,415,476	9,004	344,700
1926.....	376,770	.....	173,591,080	11,017	459,795
1925.....	387,790	.....	177,227,211	9,738	536,499
1924.....	371,850	.....	185,351,537	7,750	410,937
1923.....	426,348	.....	189,900,983	7,507	608,503
1922.....	392,277	.....	188,113,444	5,820	477,347
1921.....	104,654	.....	50,818,557	1,258	120,897
1920.....	298,211	47,157	166,001,982	5,727	378,647
1919.....	295,318	46,137	160,621,734	5,461	279,893
1918.....	332,644	45,290	173,043,136	4,256	252,437
1917.....	242,936	26,839	138,762,411	2,954	201,860
1916.....	295,075	37,891	181,518,396	2,882	257,543

* Ore included with concentrate since 1921.
(a) 1929, figures not given in company's annual report.
Operations were suspended for 7 months beginning in April, 1921.

The Tooele (Utah) Smelter

New York address: 25 Broadway. **Operating address:** J. O. Elton, mgr., A. B. Young, asst. mgr., 618 Kearns Bldg., Salt Lake City. **Works address:** Tooele, Utah; B. L. Sackett, gen. supt.; Simon Jacobson, lead plant supt.

This lead and copper smelter is at International, 6½ miles from Tooele Junction on main line of the San Pedro, Los Angeles & Salt Lake R. R., connection being made by means of the Tooele Valley Ry. Co., owned by International. Plants and yards cover one-half square mile, also 1000 ton selective flotation concentrator.

Crushing and Sampling plant: 5-story buildings, 2 complete sections using the Brunton system of sampling, contains 8 Blake type crushers, 9 to 12"x15" x15" to 24" in size and 8 rolls, 12 to 15" wide and 26", 42" and 48" diameter. Each section contains 4 Brunton sample cutters. In the copper plant ore is crushed to ⅜", conveyed from sample mill to roaster storage bins (5,000 tons capacity) and thence to roaster feed hoppers by belt conveyors.

Copper Department: the McDougall roaster building contains 2 sections, each 64x162' holding 32 furnaces. These furnaces are 16' in diameter, 18' high and have 6 hearths. Roaster gases passing thru 120x140' hopper-bottom brick dust-chambers 30' high above the hopper, thence to flue type Cottrell treater, thence thru brick flue to stack. Each unit of the Cottrell treater has an effective electrode length of 40' and effective cross section of 113.5 sq. ft. The brick stack is 350' high and 25' inside diameter at the top. The reverberatory plant receives the calcine by electric tram system. It contains 5 coal-fired furnaces. Anaconda type, 1 with 19'x90' hearth, 4 with 19'x102' hearth. Total annual capacity is rated 500,000 tons of ore. Each furnace is equipped with 750-h. p. waste-heat Stirling boiler. Gases go through a brick flue, 1,360' long to stack.

The converter plant has 5 electric-driven stands for 96x150" shells and a 60-ton crane. Converter shells are basic lined. Gases from plant go through a steel flue to a 50x126' brick baghouse containing 960 31x1'6" woolen bags. From the baghouse the gas is discharged through a 150' stack 15' in diameter at the top.

The power house contains 2 Corliss engines direct-connected to 250-k. w. 500 v. d. c. generators; one 350-k. w. 500 v. d. c. turbo generator set; 2 vertical triple-expansion engines direct-connected to 750-kva. 2,200-v. generators; one 750 k. w. 2,200 v. turbo generator set; 2 converter blowing engines, 15 lbs. air; 1 steam-driven 90 lb. air compressor; 1 electric-driven 90 lb. air compressor; 2 No. 10 Roots blowers, direct-connected to tandem compound Corliss engines; and 2 Leblanc condensers and necessary auxiliaries. Condensing water is cooled in natural draft cooling tower. In addition to the waste-heat boilers, there are 3 hand-fired 350-h. p. Stirling boilers.

Copper is cast in steel molds by 30-ton electric crane. Slag is granulated in an inverted cone-type granulating tank, from which it is withdrawn by a bucket elevator, loaded into railroad cars, and sent to the lead blast furnaces.

Lead Department: Contains blast furnaces, sinter plant and charge bins. There are 26 double steel bins with a capacity of 10,000 tons of ore and concentrate, receiving material from the crushing plant by belt conveyor. Fine concentrates and ores already sampled can be dumped direct. Charges for blast furnaces are weighed in scale hoppers dropped into charge cars, going direct to furnaces.

Charges for sinter plant are made up by rotating table feeders underneath each bin, and are discharged onto belt conveyor, which delivers material into continuous mixer, whence it is taken by other conveyors to 10 Dwight-Lloyd sintering machines, 42x164", capacity 225 tons per day per machine. Sinter from machines goes to blast-furnace charge bins by standard railway cars. Gases from this plant pass through standard Cottrell treater of 4 units of 220x15'x12" diameter pipes each.

The blast-furnace plant is a steel and concrete building with five 52x180" furnaces. Total annual capacity is between 500,000 and 600,000 tons of charge. Gases pass through balloon flue to brick bag house containing 1,440 bags, lead to drossing plant and the lead-copper matte to the converter

plant. The drossing plant has four 30-ton kettles and uses a Howard press.

Industrial equipment includes four 18-ton and four 12-ton electric locomotives, with necessary slag trucks, matte trucks, calcine and coal cars, a fully-equipped assay office and laboratory, shops, weather observation department, emergency hospital, office, etc. All buildings are of steel and concrete construction. About 1,200 men employed.

The smelting practice of copper ores largely follows Anaconda methods. The sulphide fines are roasted with a certain amount of siliceous ore added upon the fifth hearth of the roaster to heat the ore and keep the temperature at the right point. The ore is roasted down to 0.7% sulphur corresponding to a matte fall of 15 to 18 tons per day. The reverberatory slag, carrying 40 to 42% silica, is tapped at the back of the furnace and the matte, carrying 20 to 30% copper, conveyed in ladles to the converters. The converters, when operated only on day shift, are kept hot over night by filling them with cinders from the reverberatory furnaces. Silica is applied to the converter in lump ore, 2 boats to each 8-ton charge. The bag-house dust from the smelter fumes is removed by reversing the fan and direction of current, drawing the dust into the chamber beneath.

Direct connection with the mines at Bingham, is made through the Utah Metal & Tunnel Co.'s 11,500' tunnel, completed in 1913.

Production:

Year	Copper ore tons	Lead ore tons	Copper lb	Lead lb	Gold oz.	Silver oz
1929 (a).....	.....	.....	.....	.....	.....	.....
1928.....	117,029	294,526	20,654,286	145,613,624	65,117	8,439,372
1927.....	116,910	288,300	20,119,391	146,073,315	56,850	8,001,707
1926.....	88,593	285,295	19,202,538	135,658,034	16,100	8,723,505
1925†.....	78,762	234,046	20,669,490	112,105,154	33,842	8,479,090
1924.....	97,057	164,521	28,378,326	75,967,432	28,026	5,739,123
1923.....	100,765	196,550	31,056,440	63,538,501	28,524	6,327,395
1922 (6½ mos.)	40,193	77,663	10,879,094	20,271,233	11,579	2,685,836
1921*.....	.....	61,707	1,281,558	9,216,564	4,297	1,529,566
1920.....	104,210	200,788	9,901,906	46,136,951	22,580	4,180,890
1919.....	131,395	237,164	13,699,506	62,189,472	28,431	5,485,424
1918.....	262,723	297,847	21,821,657	62,034,920	36,317	5,827,135
1917.....	320,510	334,274	17,385,090	84,726,315	31,495	4,439,290
1916.....	442,756	421,197	20,041,089	117,976,091	40,009	5,549,777

* Copper plant not operating; lead plant for 6 mos. only.
† Concentrator treated 284,766 tons of ore from which there were produced 93,323 tons of concentrate, of which 40,697 tons were zinc concentrates which were shipped to electrolytic zinc plant at Great Falls.
(a) Figures not available.

RARITAN COPPER WORKS

Subsidiary of the Anaconda Copper Mng. Co.

Local address: W. T. Burns, mgr., Perth Amboy, N. J. F. R. Pyne, supt.; Edw. J. David, supt. elec. refineries.

The works on New York harbor, completed 1899, and since enlarged repeatedly, is one of the largest and most modern electrolytic copper refineries in the world. Expenditures planned in 1925 with installations in 1926 give plant capacity of 45,000,000 pounds of copper monthly. This will provide for handling production from the Andes Mines in Chile.

The smelting department consists of one 200 ton, one 150-ton and one 100-ton furnace for casting anodes, and two 225-ton, one 150-ton and two 100-ton furnaces for casting wire bars, ingots and cakes.

The electrolytic refinery includes 2 tank houses with their respective power houses; power consumption being about 7,000 k. w. The department has special shears for trimming cathode sheets and Morrow loop machines for attaching copper lugs to the cathode starting-sheets.

No. 2 tank house, 210x582', has 3 bays running lengthwise, with two 10-ton 3-motor Whiting cranes in each bay, equipped with special devices for

handling an entire tankful of anodes or cathodes at 1 load. There are 3 electric circuits running lengthwise, 1 in each bay, each circuit of 396 tanks being handled from the power house by an electric generator. Current is 7,500 amperes, giving a current density of 20 amperes per sq. ft. The main conductor has a cross sectional area of 12¼". There are 1,188 depositing tanks arranged in 108 nests of 11 cells each, with electrode arrangement on the Walker system. Tank house No. 1 has 1,800 tanks; its general arrangement, and method of operation, is very similar to that in No. 2.

No. 1 power house, which furnishes power for No. 1 tank room, contains four 1,000 k. w. triple expansion Corliss engines and barometric condensers. The engines are direct-connected to four 1,000 k. w. electric generators. Beginning with 1920, fuel oil was substituted for coal throughout the plant; two 55,000 bbl. storage tanks were installed. In early-1929 the use of coal was resumed.

Production:

Year	Copper lb	Gold oz.	Silver oz.
1929 (a)	.....	.....	.....
1928	391,124,387	157,642	17,073,358
1927	378,099,665	147,438	18,896,528
1926	393,201,524	132,335	21,735,902
1925*	405,803,075	128,591	20,578,003
1924	406,548,498	117,520	20,037,558
1923	398,294,865	98,914	20,643,095
1922	300,284,594	33,874	8,086,858
1921	169,700,240	51,474	10,370,834
1920	245,473,190	76,746	14,320,832
1919	326,671,962	120,629	19,503,574
1918	394,968,011	132,254	21,440,611
1917	411,933,742	137,465	19,938,375
1916	462,666,262	167,024	18,606,866

* Besides 28,335 lbs. selenium, 570 lbs. tellurium, 454.815 lbs. nickel sulphate, 1,054,000 copper sulphate, 253.92 oz. platinum and 748 oz. of palladium.
(a) Figures not available.

INTERNATIONAL LEAD REFINING CO.

Subsidiary of the Anaconda Copper Mng. Co.

Works address: G. E. Johnson, supt., East Chicago, Ind. New York address: 25 Broadway.

An extensive plant located at 151st St. and McCook Ave., East Chicago, Ind., on 64 acres of ground, erected in 1912. Plant comprises main refinery building, all steel and concrete, with 3 standard-gauge tracks entering the building. There are 2 crane runways running the full length of the building, with 3 traveling cranes. A change-house, of brick, is equipped with toilets, shower-baths, steel lockers, and a dining room. Bag-house is constructed of brick and concrete, divided into 4 compartments of 114 bags, 30'x18".

Equipment: consists of one 12,000-ton battery Parkes process, two 300-ton softeners, four 60-ton desilverizing kettles, one 300-ton refining furnace, and one 200-ton molding furnace. The bullion comes in on a high track, is charged into furnace with charging machine and flows by gravity through the plant. Lead is hand-molded and trucked into cars. Sampling is done in two 40-ton kettles and bullion pumped into softeners with centrifugal pump. Residues are worked up in three 30-ton reverberatory furnaces. There are two 40-ton blast furnaces, 1 for antimonial slag, and 1 for by-products and ores; 8 retort furnaces for treating zinc skim and two 5-ton cupels for treating high-grade retort metal.

Common lead is double refined by crystallization in kettles in the corroding lead plant. All furnace gases except from softeners and retorts are drawn through a sheet flue 700' long and passed through the bag-house.

According to G. P. Hulst (Bull. 153 Sept., 1919, A. I. M. & M. E.) the works are able to treat both oxide and sulphide ores of antimony. All silver-bearing antimony ore is heated in the residue furnace, while antimony slag produced was low enough in silver to warrant being smelted in two 42" round blast furnaces to antimonial lead. When the domestic output of antimony ore increased in 1916, the International was ready to treat it.

Power is supplied by the Northern Indiana Gas & Electric Co. Two waste-heat boilers supply steam for compressors and refinery. High-pressure air is supplied by centrifugal air compressors and air for blast furnaces is supplied by a Connersville blower. Water is supplied by East Chicago Water Co. to 50,000 gal. tank, to which waste water also is pumped from a 100,000 gal. sump-tank. Oil storage capacity, two 12,000 gal. oil tanks.

Production:

Year	Lead bullion treated tons	Com. and cor'd'g lead lb	Antimonial lead lb	Gold oz.	Silver oz.
1929 (a)	.....	.....	.....	.....	.....
1928	88,499	165,511,434	7,148,635	40,986	7,805,496
1927	86,561	162,012,930	6,519,910	32,821	7,433,720
1926	83,182	154,898,754	8,112,230	24,267	8,319,378
1925	67,137	124,616,850	6,592,715	21,932	7,571,424
1924	57,479	105,637,507	5,930,688	18,113	5,907,412
1923	52,096	97,118,093	6,376,821	20,328	6,945,450
1922	12,843	22,319,149	.....	3,750	1,486,553
1921	11,243	20,638,128	914,875	9,021	2,612,960
1920	27,724	49,173,237	2,811,008	11,897	3,438,371
1919	38,774	69,884,930	6,402,350	24,428	6,311,227
1918	65,885	113,074,263	13,018,043	36,361	7,004,176
1917	65,240	117,922,724	11,525,365	24,673	5,259,738
1916	64,917	108,009,116	15,682,151	20,580	4,468,775

(a) Figures not available.

Having experimented with a pilot plant, construction of a 20-retort French process plant at East Chicago with daily capacity of 16,000 lb. of zinc oxide per day, was begun and completed Jan. 1923. A similar plant was erected at Akron, Ohio, 2 units commencing production during 1923.

Anaconda Lead Products Co.: G. E. Johnson, supt., was formed in 1919 to manufacture electrolytic white lead. Its plant is at East Chicago, adjacent to that of International Lead Rfg. Co.

AMERICAN BRASS CO.

Early in 1922 the Anaconda Copper Mining Co. and its subsidiary, the United Metals Selling Co., acquired over 99% of the capital stock of American Brass (outstanding $15,000,000, par $100) by payment of $150 in cash and 3 shares of A. C. M. Co. stock for each share of the American Brass Co., which was incorporated in February, 1899, under the laws of Connecticut, and which was the result of a consolidation taking place in 1912 between the following companies: Ansonia Brass & Copper Co., Benedict & Burnham Mfg. Co., Coe Brass Mfg. Co., Waterbury Brass Co., Chicago Brass Co., Holmes, Booth & Haydens Co. In 1917 the Buffalo Copper & Brass Rolling Mills was acquired, and since the acquisition of American Brass by Anaconda there has been purchased the property of the Brown's Copper & Brass Rolling Mills, Ltd., at Toronto, Can., excepting the land and buildings, which were leased for a long period. Also the assets and property in 1923 of the National Conduit & Cable Co., Inc., situated at Hastings-on-Hudson, N. Y. (purchased by American Brass at receiver's sale for $3,000,000). The Detroit Copper & Brass Rolling Mills were purchased in mid-1927. A new corporation known as Anaconda American Brass, Ltd., all of the stock of which is owned by American Brass Co., was formed to conduct the Canadian operations and to better serve the Canadian trade. In addition to its other Waterbury plant company in March, 1929, purchased all of the issued stock of French Mfg. Co., of Waterbury, one of the most successful fabricators of small seamless tubes.

Exhibit "A"

CHRONOLOGICAL REPORT

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CLOSING AND SALE OF EAST CHICAGO PLANT

November 30, 1946

OUTLINE

OUTLINE

I. HISTORY OF PLANT

1. Lead Refinery

Introduction

The Parkes Process lead refinery of the International Lead Refining Company at East Chicago, Indiana was built to treat the lead bullion produced by the lead smelter of the International Smelting and Refining Company at Tooele, Utah.

Construction

The plant was designed and constructed under the direction of Mr. G. P. Hulst. Ground was broken April 16, 1912 and exactly six months later the plant was in operation and refined lead was being cast. The capacity of the plant as designed was 5,000 tons of bullion per month.

In the paper presented by Mr. G. P. Hulst before the American Institute of Mining and Metallurgical Engineers at the Salt Lake City meeting in August, 1914, Mr. Hulst acknowledged the assistance rendered by R. Ruetschi in the preparation of plans, C. W. Wilson, L. Crook and F. E. Stolte in the work of construction, and Herman Witterborg in the operation of the plant.

Operation

The lead refinery as constructed was undoubtedly the most modern of its kind at that time. Mr. Hulst and his staff were able to take advantage of the knowledge of lead refining to that date and consolidate it into a modern, well-arranged lead refinery that had been the model for lead refineries for many years since that time.

Effect of World War I

The plant was well developed into efficient operation when World War I began in August, 1914. The greatly accelerated demand for lead and the higher prices for common and antimonial lead permitted the International lead refinery to refine bullion from Mexico, Canada and various points in the United States, to its fullest capacity. In 1917 and 1918 a third softening furnace was constructed and the desilverizing kettles were increased in size from 60 tons to 135 tons. Two additional 135-ton kettle settings were also constructed. The original three residue furnaces were consolidated into one large residue furnace.

The acute shortage of antimony during the war and the genius of G. P. Hulst permitted the treatment of large tonnages of antimony ore imported from Mexico for the production of large quantities of antimonial lead.

Post War Problem

The plant passed through a rather critical period during the post war period because of the low metal prices and the consequent

declining production of lead bullion at Tooele, Utah and the construction of lead refineries in Mexico to treat the Mexican bullion that formerly had been treated at East Chicago.

Battery Plates

In the early 1920's when tonnages of Tooele bullion were low, careful study was made of the possible use and treatment of battery plates. Through the initiative of the East Chicago staff large tonnages of battery plates were treated and considerable income was derived therefrom. In the depression of the 1930's battery plates and secondary lead materials were bought in large quantities in order to obtain an income that would justify operation of the plant.

Selective Flotation Effect

The improvement in selective flotation methods for separation of zinc from lead released tremendous tonnages of high zinc lead ore that formerly had been economically unattractive because of high zinc penalties. These developments increased the tonnage of concentrates that could be treated at Tooele. The capacity of the East Chicago refinery was exceeded in 1926 and 1927, and in 1928 and 1929 substantial additions were made in the equipment in order to increase the capacity of the plant up to 10,000 tons of bullion per month.

1930 Depression

In the late 1930's the tonnages of bullion available from Tooele were not encouraging. They kept declining, higher labor costs were also experienced, culminated by the beginning of World War II with its freezing the price of lead at 6.50¢ per pound and its elements of increased cost, labor inefficiency and extreme shortages of labor. The extreme shortages of labor were in part compensated for by the employment of women in all of the plant operations for the first time in the history of the plant. They proved to be adequate to maintain production but were obviously inefficient as compared to a normal male working force.

Bismuth Recovery

In 1935, the lead refinery substantially changed its mode of operation because of the treatment of the Anaconda Roaster Residue at Tooele and the separate production of a high bismuth bullion which was desilverized by the Parkes Process. The anodes containing lead and bismuth were delivered to the white lead plant for the recovery of bismuth from all of Anaconda's operation. More will be said about this development in the history of the white lead plant.

Personnel

In addition to the personnel who built and started the operation of the plant, mention should be made that in the summer of 1918

Mr. M. W. Krejci was transferred from the Montana operations to East Chicago as Refinery Superintendent. Mr. F. P. Clark, former Chief Chemist at East Chicago was made General Foreman of the Lead Refinery and contributed a great deal in the operation of this department. He was promoted in 1925 to Lead Refinery Superintendent and remained in that capacity until his death in March, 1942.

2. White Lead

Lead Marketing Problem

In 1919, it was recognized that outlets for refined lead would be distinctly limited in the post war period. In recognition of these conditions, it was decided to look into the possibilities of producing some lead product that would form an outlet for a substantial part of the pig lead produced at East Chicago.

Under the direction of Mr. William Wraith as President of the International Lead Refining Company, it was decided to investigate the possibilities of the Sperry Process for the production of electrolytic white lead.

Sperry Process Investigation

With the help and guidance of Mr. Elmer A. Sperry and under the direct supervision of Mr. M. W. Krejci a small experimental Sperry cell for the production of electrolytic white lead was started in a special building at East Chicago and known as Building C013.

Sperry Process Development

In this small experimental plant the Sperry Process was developed into a commercial process and plans were immediately made for a 10-ton electrolytic white lead plant to be constructed at East Chicago.

White Lead Plant Construction

The appropriation request for construction of the 10-ton white lead plant was approved July 3, 1919. The plant was placed in operation January 30, 1920.

Personnel Changes

On February 1, 1920 Mr. G. P. Hulst and Mr. Milo W. Krejci resigned from the International Lead Refining Company to engage in other activities. Mr. O. M. Kuchs was appointed Manager and G. E. Johnson was appointed Acting Superintendent of the East Chicago plant which included the lead refinery and the white lead plant which had just been placed in operation.

Of the men who started in the original development of the

Sperry cell at East Chicago, mention should be made of Mr. T. E. Cook who was invaluable in the solution of the early problems of making the process practical and relatively simple for workmen to understand.

Mr. E. A. Mayhew started as a filter operator in the experimental plant. Later, by successive stages he became a foreman of the white lead plant and remained in that capacity until made General Foreman of the white lead plant which was his position when operations were discontinued in July, 1946.

Mr. R. G. Bowman contributed a great deal to the development of the Sperry Process in its early commercial operation. He was transferred from Tooele, Utah to East Chicago in May, 1920. He later became Assistant Superintendent of the East Chicago plant and continued active on the management staff at East Chicago until July, 1946 at which time he occupied the position of General Superintendent.

Mention should be made of the many years which Mr. W. J. Knox spent as White Lead Plant Superintendent. Among the research men succeeding Mr. Knox as research department heads were T. H. Donahue, S. W. Stockdale and W. W. Shropshire.

Mention should also be made of Mr. Perry S. Toney as Mechanical Superintendent. One of the important developments which he contributed was the anode washing machine which is gradually being extended in its use to all types of electrolytic washing operations.

Development of the Bismuth Plant and the recovery of all of Anaconda's bismuth through the white lead plant was in part started by Mr. T. H. Donahue when he was in the research department. It was expanded into a practical operation when Mr. Stockdale was head of the research department.

A great deal of exploratory work in the use of the Sperry Process for the refining of impure metals and the production of a superior white lead was actively studied in the 1930 period. Many possible processes were also explored in an experimental way, some of which will no doubt become commercially attractive in future years.

3. Zinc Oxide

In March, 1921 Mr. G. S. Brooks arrived at East Chicago for the purpose of building and operating an experimental zinc oxide furnace. It was proposed to produce zinc oxide from electrolytic zinc received from the Montana operations of the Anaconda Copper Mining Company. The experiments using oil as a fuel proved successful and a commercial unit consisting of Block No. 1 - French Furnace operation at East Chicago - was built. Ground was broken in July, 1922 and the unit began operating on January 1, 1923. No. 2 French Block was built and began operations in October, 1924. In addition to Mr. Brooks, Mr. F. O. Case, Mr. L. G. Duncan, Joe Mickel and Len Clark were important in the development of the zinc oxide business at East Chicago.

In 1923, to further expand the zinc oxide business, it was decided to build a plant similar to Block No. 1 at East Chicago at Akron, Ohio with the thought that this would supply zinc oxide to the large rubber companies operating in the city. Promotion of the use of French Process zinc oxide in rubber manufacture was one of the important developments accomplished by the zinc oxide department.

Mr. F. O. Case had a great deal to do with the construction of the Akron plant and its later operation and handled the sale of the production. Mr. T. R. Janes, J. F. Clark and Joe Klimek were important men in the Akron organization.

Mr. F. H. Hurless entered the employ of the company at Akron in November, 1922 as a clerk in the office. He later assisted Mr. Case in sales work at that point and was transferred to East Chicago in 1929. He later became District Sales Manager and in 1936, Assistant Sales Manager, assuming the position of Sales Manager in 1942.

In 1925, Mr. G. S. Brooks was promoted to the position of President of the Geische Spolka Corporation of Poland. When he left Mr. F. O. Case succeeded him as Manager of the zinc oxide department at East Chicago and Akron. At that time Mr. L. G. Duncan who had been with Mr. Brooks in the initial venture was placed in charge of the Akron plant. Zinc oxide sales reached a volume of 30,000 tons annually.

Development of Zinc Oxide Production from Scrap Zinc

It had been recognized in 1935 and 1936 that some other source of zinc might become necessary because of the uncertain supply from the west. There was also an increasing amount of scrap becoming available as die cast scrap in various forms which every one recognized would ultimately become a problem to reclaim. Therefore, in the years between 1935 and 1937 efforts were made to find some process of using scrap zinc for the production of zinc oxide. In this development, R. S. Olsen and George Anderson had a considerable part and were later granted patents for the fundamental characteristics of the muffle furnaces which have been so successfully used at East Chicago.

In 1936, Mr. Case was promoted to Manager of the Midwest District of the International Smelting and Refining Company and with that change Mr. Johnson was made Plant Manager for the East Chicago and the Akron plants. Mr. Duncan was made Sales Manager.

In 1937, the power shortage in Montana created a serious situation in the zinc oxide business at Akron and East Chicago. There was not enough electrolytic zinc available for zinc oxide production.

It was decided to discontinue the operations of the Akron, Ohio plant and it was closed down in September, 1937. A few of the Akron employees were transferred to East Chicago but most of the former Akron employees remained in Akron, Ohio.

The operations of the muffle furnaces became an increasingly important part of the zinc oxide operations at East Chicago, and at the time of the closing of the plant in August, 1946 the muffle furnaces had been developed to the point where all forms of zinc oxide produced at East Chicago such as U.S.P. quality, ceramic, paint and rubber oxides were all produced on the muffle furnaces from scrap zinc.

4. Lead-in-Oil

Substitution of other pigments for white lead in the ceramic and paint industries caused a shrinkage of sales which became quite serious. In 1930 a survey of the lead-in-oil market was made and in 1931 the production and sale of this product was begun.

That area of the country east of the Mississippi River and north of the Ohio River was actively solicited. Over 2,000 outlets were established and the tonnage of dry white lead sold as lead-in-oil amounted to over 30% of total dry lead production.

Beginning with World War II shortages of materials and restrictions on their use as imposed by WPB and CPA reduced the volume of lead-in-oil available for sale. However, production and sales were maintained on a reduced basis throughout the war and until the closing of the East Chicago plant.

III. SHUT-DOWN PROCEDURE

1. General

May 15, 1946 — Discussions, studies and events at this stage were approaching a decision which seemed to crystallize as definitely unfavorable for the East Chicago plant.

May 22, 1946 — Decision made at New York to close the East Chicago plant.

Instructions were issued to begin shutting down all operations at East Chicago.

At the same time, instructions were issued to Tooele to store any bullion they had on hand for later shipment to Omaha.

It was understood that the main operations of desilverizing and treatment of the silver-bearing by-products should be completed in the silver room as soon as possible.

By-products from the material on hand should be treated in the residue furnace and subsequently in the blast furnace; the residue bullion to be shipped to Omaha.

The balance of the by-products left in any department were then to be shipped either to Tooele, Omaha or disposed of elsewhere to the best advantage in order to cease operations in the lead refinery as soon as possible.

June 1, 1946 — Instructions were issued to advise the trade that the International Smelting and Refining Company was to discontinue the operation of the pigment plant at East Chicago and that they were going out of the pigment business as soon as the stocks of pigments at East Chicago and in warehouses had been sold.

The salesmen were instructed to advise the customers that the International Smelting and Refining Company would do the best it could toward taking care of their requirements but that very little production would be available to take care of them beyond July.

Letters were sent to the mixed metal, white lead and zinc oxide customers notifying them that International was shutting down the East Chicago plant and permanently going out of the business of producing these products.

June 20, 1946 — Similar letters sent to the lead-in-oil customers

2. Lead Refinery

April 12, 1946	Last copper bearing lead was produced.
June 17, 1946	Desilverizing kettles shut down.
June 18, 1946	Chlorination machine shut down. Last of the low bismuth common lead was molded.
June 19, 1946	Last of the high bismuth common lead was molded.
June 24, 1946	Retorts were shut down.
July 4, 1946	Residue furnace shut down.
July 6, 1946	Caulking lead was last molded.
July 11, 1946	The last anodes were molded for the white lead.
July 12, 1946	Cupels were shut down. The last production of F-3 alloy for Anaconda Wire and Cable was molded.
July 23, 1946	Blast furnace run was ended.
August 2, 1946	The last antimonial lead was molded.
August 9, 1946	The Bismuth Plant was shut down and all bismuth produced.
August 21, 1946	The baghouse furnace was shut down which placed all departments on a shut-down basis within the lead refining unit.

3. White Lead

May 31, 1946	Request was made of Washington to permit the use of the remainder of the lead quota, available for the production of white lead to the International Smelting and Refining Company, to be used up as soon as possible in order to speed up the shutting down of the plant.
June 3, 1946	Authority was received from Washington to use the entire quota of lead as soon as possible. Operations at the white lead plant were increased to capacity.
July 16, 1946	The plant operated at capacity until 4 P.M. when the electric power in the cell room was shut off.
July 17, 1946	The Moore filter was shut down at 8 A.M.

July 22, 1946	The Lowden Dryer was shut down at 3:30 P.M.
July 25, 1946	The Raymond Mill was shut down.
July 27, 1946	Last lot produced - Lot 6-223.

4. Zinc Oxide

June 3, 1946	It was decided to operate all the Muffle Furnaces at the plant as soon as possible in order to complete treatment of the scrap on hand in the most economical manner and in the shortest period of time. Four Muffle Furnaces were operated during most of June and until early July.
July 5, 1946	#1 Muffle Furnace shut down.
July 8, 1946	#2 Muffle Furnace shut down.
July 15, 1946	The Packer was shut down.
August 5, 1946	#3 and #4 Muffle Furnaces were shut down after treating the residue metal and producing Prime Western Zinc from such treatment. The residue metal was sold to the Inland Metal Company, East Chicago.

It should be noted that in the late operations on #1 and #2 Muffle Furnaces both furnaces were producing U.S.P. oxide and high grade zinc.

The last operation on the American Block was March 15, 1945.

It should also be noted that the last operation of the French Furnace was completed on March 31, 1945.

5. Lead-in-Oil

July 23, 1946	The Lead-in-Oil Plant was shut down.

IV. LIQUIDATION OF STOCKS AND MISCELLANEOUS AFFAIRS

1. Lead Refinery

July 27, 1946	The last common lead was shipped.
August 22, 1946	All antimonial lead was shipped out.
Sept. 23, 1946	The last by-products were shipped to Omaha.
Sept. 30, 1946	The last of the by-products were shipped to Tooele.
Sept. 30, 1946	The final clean-up of all metal in the plant was made to the U.S.S. Company.

2. Pigments and Mixed Metals

A. East Chicago

	1946				
	June 1	July 1	Aug. 1	Sept. 1	Oct. 1
Lead-in-Oil	104,310	38,556	245,259	-	-
Mixed Metals	976,169	1,000,078	986,982	-	-
White Lead Dry	262,250	1,246,300	394,850	-	-
Zinc Oxide	1,128,350	1,646,800	573,950	252,350	-

B. Warehouses

Lead-in-Oil	82,039	45,958	11,401	-	-
White Lead Dry	215,550	108,350	247,550	-	-
Zinc Oxide	369,250	269,300	446,300	51,600	-

Mixed Metals not carried in outlying warehouses.

Dates warehouse stocks were liquidated:

Akron	7/24/46
Boston	8/19/46
Brooklyn	8/29/46
Indianapolis	7/22/46
Jeannette	7/6/46
Los Angeles	9/16/46
Louisville	7/30/46
Minneapolis	7/10/46
Newark	9/3/46
Philadelphia	8/23/46
Portland	8/28/46
San Francisco	9/16/46
Seattle	8/12/46

3. Store Room

During July, a complete inventory was taken of the storeroom supply accounts for purpose of giving our other plants a chance to select any surplus items that are not on the market, also for the purpose of establishing a value for sale with the property.

This listing included over four thousand items with a total of approximately $140,000.00. This was not limited to a book inventory but listed all material and supplies that had been charged to operations and found in the storeroom with charge-out tickets. All of List 2, containing over nine hundred bolt and screw items were counted and totaled $2,185.92. All of List 10, containing new equipment, amount $3,471.54, was not on our books but included in the sale of the property. The plant was combed closely for such items.

All undelivered material on open purchase orders was cancelled. Some of the material was in process of fabrication and could not be cancelled. The total loss on such items will aggregate not over $4,000.00. All miscellaneous material and supplies, including all equipment that has been received since the shut-down, have been purchased by The Eagle Picher Company. All such items, up to September 1st, were included in Sheet 9 in the general sale. All items, after September 1st, will be adjusted in our accounting procedure of debits and credits during the final accounting.

4. Miscellaneous Affairs

The accounts receivable, on September 30th, was $23,518.96 and we expect to collect all with no bad debt loss. There is a reserve of over $45,000.00 for bad debt losses.

All circular mail addressed to employees of the International Smelting and Refining Company, as well as to the Company, is being returned to the sender, stamped "Please remove individual and company name from your mailing list. Plant is closed". The volume of mail was 1,189 items the first week and is still of considerable quantity. All first-class mail is forwarded.

Cancellations of contracts, agreements, permits and subscriptions have been in daily progress. These include the utility, water, telephone, laundry, window cleaning, oxygen and acetylene, switching and weighing, State of Indiana on Gross Income Tax, withholding tax, personal and real estate tax.

State of Indiana contribution balance for unemployment compensation final accounting will take place when all claims are paid. This balance, around $99,000.00 will be reduced by unemployment claims which should not exceed $5,000.00. The refund will not include any money allocated to the "Pool Fund". These figures are available in the New York Office.

Treasury Department permit for specially denatured alcohol was full of red tape but was finally disposed of and bond cancelled.

Industrial Board of Indiana notice and arrangement for a continuation of carrying our own risk without insurance until all liability claims are paid.

There are several compensation cases pending that have been in progress of final settlement. Our reserve for this risk is down to $14,804.54 but should be enough to take care of unsettled claims. Much time is consumed in these conferences and it will be weeks before all cases are cleared. Two hernia operations are pending.

V. DISPOSITION OF PERSONNEL

1. Accounting

July 15, 1946 — Marion Haack, comptometer operator, and Dorothy Awe, ledger clerk, were laid off. Both young girls, with less than a year's service.

August 1, 1946 — Adam Miller, metallurgical accountant, employed in 1925, and Omar Hager, accountant for the white lead plant, employed in 1936, accepted positions with the American Smelting and Refining Company at Whiting, Indiana, at no loss in salary.

William Ross, junior traffic clerk, accepted a position in the Traffic Department of the Superheater Company at a loss in salary. He was recommended to the Eagle Picher Company and they have hired him as senior traffic clerk at more salary than we paid.

Vaneta Lemley, stenographer and storeroom clerk, employed in 1927, left to accept a position with Carnegie Illinois Steel Company, South Chicago.

Alice Davis, secretary to F. E. Stolte, left to accept a position with an insurance company at an increase in salary.

Florence Przespolewski, payroll machine operator, left to accept a similar position with the Sinclair Refining Company, East Chicago

August 15, 1946 — Helen Vojvoda, bookkeeping machine operator, left to take a position doing similar work with the Sinclair Refining Company at no reduction in pay.

Roy F. Fellowes, secondary metals accountant, employed in 1927, left to accept a position in the purchasing department of the General American Transportation Corporation, East Chicago.

September 1, 1946 — J. M. Asher, paymaster, employed in 1918, left service to go into business. He has opened an employment office in Hammond.

Helen Lukeman, PBX operator, employed in 1935, accepted similar position with the Sinclair Refining Company at a better salary.

F. W. Nolen, invoice clerk, employed in 1929, left to accept position with the Calumet Iron and Supply Company, East Chicago.

Lenore Shaw, typist, employed in 1944, was released. She had several offers.

Sept. 15, 1946

H. G. Lund, credit man, formerly metallurgical bookkeeper, employed in 1914, left to accept position as credit man for a large furniture house in Chicago.

Lillian Findling, typist, employed in 1933, left to accept similar position with the F. B. Ianman Company, East Chicago. She left the Ianman Company and returned October 7th to help out until released for the Eagle Picher Company.

October 1, 1946

Bess Platis, typist, employed in 1944, left to accept any one of several offers.

I. H. Jones, accountant for Lead Refining Department, employed since 1923, left to accept a position with a small concern in Gary. He declined an offer by the Eagle Picher Company.

Stacie Anoskey, consignment clerk, employed May, 1923 left for an extended vacation. He has an attractive offer from the Metal and Thermit Corporation.

A. Williams, senior traffic clerk, finished his work at the plant and was transferred to New York pension roll.

W. F. Hines, storekeeper, employed in 1918, went on Eagle Picher pay roll and has deferred his pension arrangement.

October 15, 1946

Force reduced to:

L. A. Milne, chief clerk, employed 1916, who will leave November 1st to accept a position with the Kaiser-Frazer Company in East Chicago. He declined an offer by the Eagle Picher Company.

H. J. Dedelow, accountant for the Zinc Oxide Department, employed in 1923, will leave about November 15th for another position. He declined an offer by the Eagle Picher Company.

F. F. Stolte, assistant secretary, will finish liquidating the plant.

2. Operating

May 15, 1946

A conference was held at the New York office relative to the problem of liquidation of the East Chicago organization.

It was recognized that many of the hourly employees would have no difficulty in obtaining other jobs because of the continued acute labor shortages in the area.

The question of severence allowance for the older employees was discussed and special studies were made from a number of angles. A few of the older employees with many years' service were considered for pensions.

June 1, 1946

Steps were taken by Mr. R. J. Lawson to notify the employees that every effort would be made to help them locate positions or jobs. The personnel department at East Chicago would contact all employers in the area to ascertain their needs for help of all kinds and work with them to help locate our International employees in satisfactory positions or jobs.

It should be mentioned that a special arrangement was made with the Federated Metals Division of the American Smelting and Refining Company at Whiting, Indiana for a meeting at which the understanding was reached that the personnel departments of the two plants would work together to try to locate as many of International employees as possible with their organization.

The accounting department employees were assisted in their efforts in locating positions through the efforts of Mr. F. D. Stolte and Mr. L. A. Milne as well as through the activities of the personnel department.

The employees were advised that two weeks' notice would be given them before they would be released from the International roll. They were requested to remain on the job until the work necessary to place the plant on a shut-down basis could be completed.

June 19, 1946

Notice posted stating that the zinc oxide department furnaces would cease operating July 7, 1946. After that date some men would be employed to get the plant on a shut-down basis, maintain it on that basis and to clean up.

June 19, 1946 — Notice posted in the white lead department stating that the cell room would cease operating July 6, 1946.

June 25, 1946 — Notice posted stating that after July 15, 1946 the lead refinery and bismuth plants would be on a shut-down basis. Some men would be employed to maintain a shut-down basis and to clean up.

The notice also stated that the blast furnace run would be completed about July 15th.

Many members of the staff spent a great deal of time making contacts and follow-ups for and suggestions to the employees, both salaried and hourly, to help them locate satisfactory positions. A number of them were offered transfers to other plants of the Anaconda Company but with one or two exceptions these were not accepted.

A number of special problems was encountered, particularly in the salaried group whose age was between 50 and 60. This group was difficult to handle because they were advised in many cases that younger men were desired. Special cooperation with the New York office was helpful for several of these employees. With their help they were sent to different sections of the country for personal interviews with prospective employers.

Severances allowances and vacation pay, if due, were given all employees who were entitled to these privileges. The payment of severance allowances was handled on an individual basis. While many questions were asked concerning the basis on which severance pay was allowed, no definite information was open the employees. Approximately $60,000 was spent to give employees severance allowances.

The employees to be pensioned, few in number, were pensioned either when their services became no longer necessary or when the plant was purchased on October 1, 1946 by the Eagle Picher Company.

In retrospect it is gratifying to realize that practically all of the former International Smelting and Refining Company employees have located satisfactory positions, in many cases much more remunerative positions than they formerly held.

On October 1, 1946 all employees of the International Smelting and Refining Company, East Chicago, were notified that they were released from the International Smelting and Refining Company's payroll with the exception of a few employees in the accounting department who were needed to close out the accounts in the East Chicago office and the chemists who were needed in the general laboratory to complete the necessary assays required for settlement purposes on the metals and materials shipped out of East Chicago.

On October 1st arrangements were also made for some of the former International Smelting and Refining Company employees to be employed by the Eagle Picher Company. Special arrangements were made to have this group of salaried employees receive group insurance privileges for one year beginning November 1, 1946.

Several of the employees who had otherwise been considered for pension by the International Smelting and Refining Company were granted a leave of absence in order to be employed by the Eagle Picher Company for an indefinite period, perhaps three to five years with the understanding that at the termination of this employment by the Eagle Picher Company, they would be considered for the same privileges that otherwise might have been extended to them by the International Smelting and Refining Company.

3. Sales

Personnel Released

7/15/46	H. F. Howard	East Chicago
7/17/46	G. H. Bansch	do
7/31/46	C. D. Brownell	do
7/31/46	F. G. Engler	do
7/31/46	Ann Matikosh	do
8/15/46	Loretta Sass	do
8/15/46	L. G. Street	do
7/31/46	G. L. McKory	New York
8/15/46	W. J. Murray	do

Personnel Transferred

8/31/46	L. H. Donaldson	Transferred to Advertising Department
8/31/46	Doris McKeon	Transferred to Office at 25 Broadway
9/30/46	F. H. Burless	Transferred from East Chicago to Chicago
9/30/46	Helen Ohr	Transferred from East Chicago to Chicago

VII. SALE OF PLANT

1. Preliminary Events

June 19, 1946	East Chicago requested to prepare description of plant and equipment for study by prospective purchasers.
June 24, 1946	Appraisal of plant started by Mr. Boschen of Wilbur Jurden office.

2. Sale to Eagle-Picher

October 1, 1946	The plant was purchased by the Eagle Picher Company and they took possession on this date.

RESIDENTIAL PORTION OF USS LEAD SITE
EAST CHICAGO, INDIANA

ATLANTIC RICHFIELD COMPANY
RESPONSE TO EPA'S AUGUST 15, 2005
104(E) REQUEST FOR INFORMATION

DOCUMENTS RESPONSIVE TO
QUESTIONS #8 AND 10

THE CALUMET REGION HISTORICAL GUIDE

Containing the early history of the region as well as the contemporary scene within the cities of Gary, Hammond, East Chicago (including Indiana Harbor), and Whiting

Compiled by the
WORKERS OF THE WRITERS' PROGRAM OF THE
WORK PROJECTS ADMINISTRATION
in the State of Indiana

Sponsored by
THE BOARD OF EDUCATION OF GARY and
THE GARY COMMERCIAL CLUB
and CHAMBER OF COMMERCE

GARMAN PRINTING CO.
1939

rsenate, now dusted over southern cotton fields by airplane to destroy boll weevils, lime sulphur, Bordeaux mixture and barium silicofluoride.

One of the most colorful of the plant's products is "golf course mixture," a fertilizer for bent grass.

With an injury frequency in all its 78 plants of approximately one-seventh of that of all manufacturing industry, the Du Pont corporation ranks high in employee safety and the Grasselli plant is one of the most advanced of all its units in the technique of safeguarding workers.

(3) E. B. LANMAN CO. PLANT *(open 9-5)*, 151st St. and McCook Ave., East Chicago, in which are produced wrought washers and hot-pressed nuts, consists of long steel and brick buildings dominated by the small-pane glass in exterior walls. Within are batteries of huge bolt threaders, with their belts, cranes, and scuttles almost human in their manipulation. Bars from which the cut-thread bolts are made are of special manufactured steel from the mills of the Calumet district. As the bolts are threaded, they are gauged by hardened steel "go" and "no-go" gauges. The hot-pressed nuts are made in one operation. The heated bars of steel are fed into a machine that blanks the nut. The blanks are then burred in a burring machine and threaded in a tapping machine. The finished nut, due to the heat, appears black. The E. B. Lanman Co. was established in Columbus, Ohio, in March, 1878, as a manufactory of carriage hardware. With the advent of the automobile, only the production of washers was maintained. In the early nineties the company added a department for making cold-pressed nuts. In 1911 the plant was moved to its present location in East Chicago in order to have it near the source of its raw material, steel. The company added its bolt department in 1924.

(4) The METAL AND THERMIT CO. PLANT *(open by permit only)*, 455 E. 151st St., East Chicago, covers 14 acres with buildings of the shed type of steel, brick and wood and a substantial red brick office building. High mounds of bronze, silver, and iridescent blue shavings, like Christmas tree decorations, the raw material of this plant are trimmings from tin plate from which cans, dish pans, and toys have been cut. Such trimmings are called tin plate scrap.

The scrap is first subjected to an akali process to de-tin it. The steel scrap, freed from the tin, is pressed into hydraulic bundles and sold to adjacent steel mills. The tin is placed in containers, where it goes into solution. The solution is purified and part of it is precipitated into tin oxide. Another part is smelted to metal to form metallic tin, which is pressed into one hundred pound blocks called pig tin. Still another portion of the solution is purified further to become a special tin oxide for enameling in the ceramic industries. A small amount of the original solution is transformed into sodium stannate (salt of tin) used in electroplating tin or metal to become solder, type metals, and other white metal mixtures.

(5) The INTERNATIONAL SMELTING AND REFINING CO. PLANT *(open 9-5)*, 420 E. 151st St., East Chicago, subsidiary of the Anaconda Copper Mining Co., embraces a group of brick and steel mill buildings covering 61 acres of land. Principal operations are refining of lead and manufacture of lead and zinc pigments. The width of the lead refinery is divided into three bays, extending the entire length of the building. Two of the bays are spanned by four 15-ton electric cranes, two of 28 ft. span and two of 77 ft. span, traveling the length of the building and serving all departments. Three standard gauge railway tracks enter the building on different levels.

Lead-bullion, the material refined by this company, comes from Utah and Montana. Before reaching the East Chicago plant, the lead concentrate is smelted at a plant at Tooele, Utah, and the zinc concentrate is treated in Montana plants.

Cranes unload 4-ton blocks of lead bullion from gondola cars and drop them into the 135-ton kettles for melting. Into these kettles, heated until the molten lead reaches 1,200 degrees Fahrenheit, is shoveled mechanically, 200 to 300 lbs. of hydrated lime. The kettle is then covered with a lid (hood) to prevent dusting. Blow pipes are inserted and the mixture is blown with air from 12 to 24 hours. At intervals, the lime dross is skimmed off and with it the oxidized antimony, arsenic, and some lead.

In the de-silverizing department, spherical, steel 135-ton kettles set in brick with a coal-fired furnace below have their rims 18 inches above the floor to facilitate working the surface of the molten metal. In these, are charged the lead from the softening kettle and the dross blocks from the previous run. Metallic zinc is added, melted, and stirred into the molten lead and a zinc-silver dross is formed. This skim of mushy consistency is placed in a press which squeezes out most of the molten lead, leaving a dry crystaline dross which is broken up. The remaining lead is free from silver, but still contains 0.55 per cent zinc.

A vertical centrifugal pump is lowered into the kettle and pumps the de-silverized lead into the refining furnaces which receive 320 tons of the lead and "cook" it for 12 hours. Air or steam is blown at intervals into the metal. The zinc, lead, and remaining antimony form a layer of mixed oxides on the surface, which is skimmed off. When testing shows that all zinc and other impurities have been removed, refining of the lead is complete and the molten metal is drawn into a molding kettle. From this kettle, it is pumped to a molding machine, where the lead is molded into pigs of about 90 lbs. each.

When recovering silver, the skim, charged into six bottle-shaped retorts, 40 inches high and 19 inches in diameter, is heated in a tilting gas-fired furnace—a separate furnace for each retort. A graphite condenser fitted over the mouth of each retort permits the heating of the skim to 2,000 degrees Fahrenheit. As the zinc distills, it collects in the condenser to be tapped out through a hole. Upon the removal of the zinc, the retort is tilted and the remaining bullion containing gold, silver, and some lead, is poured out. By a cupelling process, the lead is removed as litharge, leaving the gold and silver remaining in the furnace. This is cast into bars weighing 1,000 ounces each.

An interesting building is the "bag house," a brick and steel structure divided into four chambers, each containing 144 cylindrical woolen bags 18 in. by 32 ft. in which the gases are filtered. An 8-foot sirocco fan with a capacity of 50,000 cu. ft. per minute draws the gases from the residue and blast furnaces through a brick and steel flue 680 ft. long into the bag house. The bags are shaken at frequent intervals by an electrical shaking device. Here a temperature is maintained at 200 degrees Fahrenheit. The fume (the solid matter remaining in the gas fumes) collects in concrete pits; it is then removed by hand and either treated to concentrate its arsenic content or shipped elsewhere for final treatment for the recovery of lead and arsenic. Gases from the kettles and all other furnaces are conducted through ordinary flues to a rectangular brick stack 100 ft. high.

(6) WEBER INSULATION CO. PLANT, INC. *(open 9-5; visited by permit)*, 4821 Railroad Ave., East Chicago, is a "believe it or not" industry. Within this plant heavy misshapen chunks of metal, known as lead slag, are transformed into soft, hair-like fibre to be used as insulation.

On the lower floor are furnace-like kilns (called cupolas) reaching to the next floor, into which, from above, are fed alternate layers of coke and slag. The coke is ignited and the slag is melted at a temperature between 2,600 and 3,000 degrees Fahrenheit. By steam pressure, air is forced into the mass. At intervals a small circular door in the cupola is opened and like a giant Roman candle myriads of sparks, the heated slag, are blown from the opening, and caught in a long revolving tube, in which they are cooled, screened, and conveyed to a settling chamber. When the substance is removed from the tube and settling chamber it has become a soft fibre similar to mineral wool. To increase its strength and resiliency, this fibre is placed in another swinging filtering device, through which it falls into burlap bags and is sealed for shipping as insulation. Some of the fibre undergoes a further treatment, being blended with a plastic to form cement. The fibre manufactured in this plant is used mainly by industries to cover boilers, open hearth, checker chambers, towers, tanks, and piping of oil refineries, as well as in general insulation in the walls and ceilings of buildings.

(7) S. G. TAYLOR CHAIN PLANT *(open 9-5)*, at the Illinois State Line and 141st St., is a group of three buildings, embracing 60,000 sq. ft. The iron or steel strips out of which the chains are made are mainly products of the Calumet's steel industries. The long strips, 16 to 18 ft. in length, are pressed into coils, about 3 ft. in length, by a huge pressing machine. Each coil is cut by a cutting machine into links known as "scarf links," which are then heated in ovens fired by oil. On becoming white hot, they are pounded into shape by hand and then by an arm hammer. Larger links are formed from a foot long straight pin which, because coke causes a hotter fire than oil, has been heated in a coke oven. Every chain, made as the links are formed, is tested for durability by placing each end in an iron arm and pulling. After this test, it is in-

Coils out of which smaller link chains are made are first placed in a pickling bath of sulphuric acid to remove scale or rust which might be on the raw material. As the raw material is fed into a machine in straight strips from a large coil, the links are bent into shape by two iron arms and a chain is fashioned. The smaller the link, the faster the machine operates. The ends of the links are then welded together, the links being cooled by a quenching oil, after which excess metal from welding is cut off. Smaller link chains are tested and inspected in the same way as the larger.

(8) COMMERCIAL WALLPAPER MILL, INC. PLANT *(open 9-5)*, 724 Hoffman Ave., Hammond, occupies a three-story brick structure, 40 by 300 ft. Designs for wallpaper are made in New York studios. Rollers bearing the design raised in metal or in felt bound by brass are made in a Joliet, Illinois, factory. A separate roller is used for each color of the pattern, and samples are run after the different colors are selected. A set of rolls costs from $150 to $250 and frequently $1,000 is spent in the preparation of one design of wallpaper. Paper is obtained from paper and pulp mills in Wisconsin.

Before the paper is printed, it is given a sizing of clay in the desired background color. It is dried on a system of drying racks, one placed above the other, which greatly speeds the process. The sized paper is then fed into a machine which presses it onto a large canvas wheel, which in turn, as it rotates, presses the paper on each colored roller, bringing it out on top, from where it is taken by a canvas belt back to the drying racks. Some presses can handle as many as eight or nine rollers. Water colors are used in the printing of non-washable papers; this company gives special attention to the washable type papers.

(9) W. B. CONKEY CO. (Printers) PLANT *(open 9-5)*, 601 Conkey St., Hammond, houses one of the largest bookmaking industries in the world. The plant embraces 14 acres. A modern ground floor factory building of brick, steel, and concrete with sawtooth skylight roof, erected in 1897, was, as far as is known, the first printing plant of its kind. The specially designed skylight roof permits only the north light and is constructed so that at no time do the sun's rays shine through the glass part of the roof into the working rooms. The ceramic plaque in the arch of the entrance, embracing a winged horse and tools of the engraver's art, was modeled by Lorado Taft. A landscaped park of several acres surrounds the main building.

Interior of the plant was designed for continuous-flow production through all departments. The press room is in the center of the plant. On one side are the composing, electrotype, and make-up rooms. At one end is the paper stock room and supply department. At the other end and side are the folding department and bindery. Thence the finished product moves on to the storeroom and shipping department. The centralization of the pressroom, permitting the maintenance of a uniform temperature, obviates the detrimental static electricity, which formerly

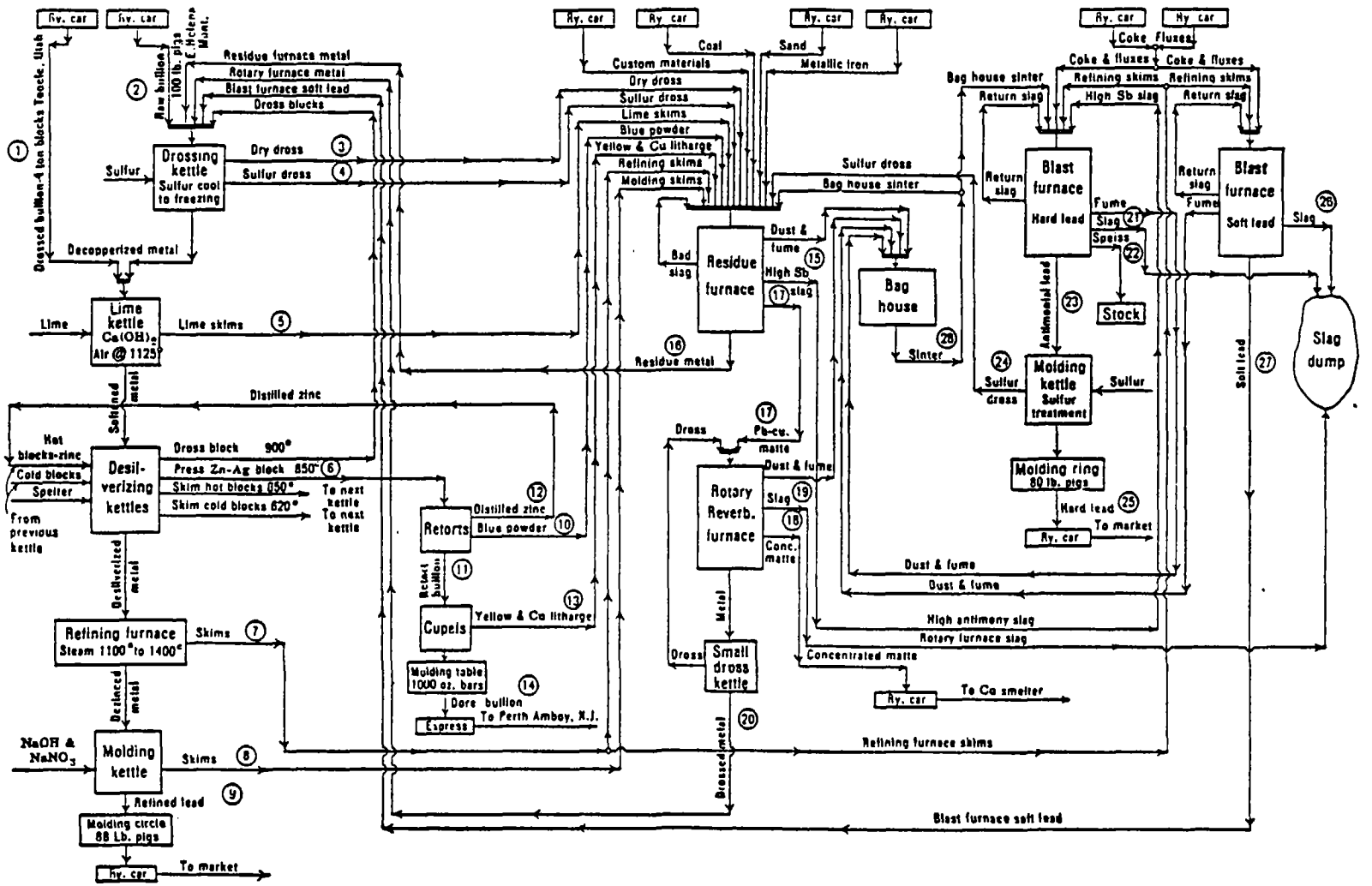
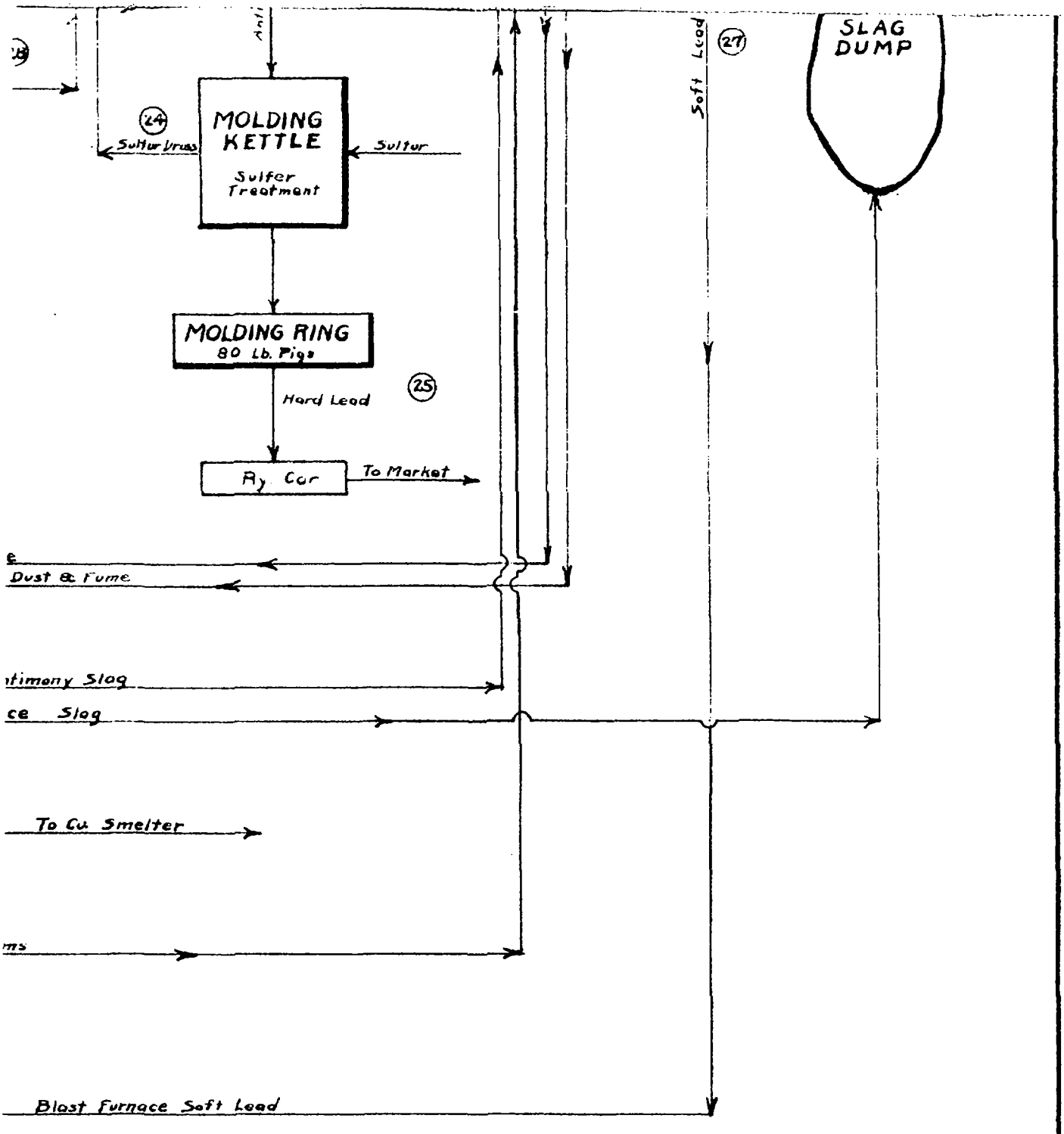


FIG. 66. The East Chicago Refinery. (*Courtesy Anaconda Copper Mining Co.*)

Figure 10



) REFINERY FLOW SHEET HICAGO PLANT	INTERNATIONAL SMELTING & REFINING COMPANY EAST CHICAGO - - - INDIANA	C-5-40

LEAD REFINING

AT INTERNATIONAL SMELTING AND REFINING COMPANY

EAST CHICAGO, INDIANA

The Anaconda Copper Mining Company's production of lead is derived from the treatment of the complex lead-copper-zinc ores of the Western United States. The majority of these ores contain the three metals mentioned in the form of sulphides, and in addition recoverable amounts of gold and silver.

The ores are first concentrated by flotation, producing three or more products, one of which is a lead concentrate, containing the greater part of the lead and silver from the ore, with small amounts of the other metals as impurities. The complete separation of zinc and lead by concentration is difficult and a certain amount of the lead from the ore is contained in the zinc concentrate.

The lead concentrate is smelted at the plant of the International Smelting Company at Tooele, Utah, an Anaconda subsidiary. The lead and silver are recovered in the form of a "bullion" containing approximately 98% lead, 80 ozs. silver per ton and small percentages of antimony and other impurities. This bullion is shipped to the International Smelting and Refining Company at East Chicago for refining.

The zinc concentrate is treated at the Anaconda plants at Anaconda and Great Falls, Montana, for the production of electrolytic zinc. The lead remains in the residue after the extraction of the zinc. This residue is smelted at the East Helena plant of the American Smelting and Refining Company and the resulting bullion, similar to Tooele Bullion in analysis, is shipped to East Chicago for refining.

The East Chicago refinery is also to some extent a custom refinery for lead bullion purchased from other sources. Lead residues and drosses from all plants of the Anaconda company are treated, and limited quantities of scrap battery plates, lead drosses, and secondary materials are purchased.

The plant is a Parkes process lead refinery of 96,000 tons' annual capacity, producing common desilverized pig lead, antimonial lead, and dore' bullion.

The principal operations are performed in one main building of all-steel construction, 480 x 180 x 50 ft. Separate buildings are provided for the general office, laboratory, research department, store-room and shops, change house, and mess hall. The width of the main refinery building is divided into three bays, extending the entire length of the building. Two of the bays are spanned by four fifteen-ton electric cranes, two of 28-ft. span in one bay, and two of 77-ft. span in the other, which travel the length of the building and serve all departments. Three standard-gauge railway tracks enter the building on different levels. The general arrangement of the furnaces and kettles permits the flow of most of the metal by gravity from bullion to refined metal.

Gases from the residue and blast furnaces are drawn through brick and steel flues by a 50,000 cu.ft. fan to a bag house. Gases from the kettles and all other furnaces are conducted through brick flues to a rectangular brick stack 4 x 4 ft., and 100 ft. high.

[redacted] electric power for [redacted] operations is purchased from the Northern Indiana Public Service Company. Water is obtained from the city mains, which supply a [redacted]-gal. tank elevated 50 ft. Water discharged from furnace jackets is returned to a 100,000-gal. sump tank and is pumped to the elevated tank. Steam is supplied from the plant of the Anaconda Lead Products Company. Fuel oil is received in standard tank cars on the high line track, and unloaded by gravity to storage tanks. Auxiliary equipment is housed in a brick and steel building west of the main refinery building. The building contains two electrically driven air compressors, a centrifugal compressor which furnishes air for oil burners, a 1,000-g.p.m. motor-driven water pump, and a steam-driven fuel oil pump.

REFINING OPERATION:

The purpose of the refining operation is to convert all materials treated into the following marketable products, - common lead. antimonial lead, dore' bullion and lead-copper matte.

The major steps in the refining operation are:

Softening:- The removal of antimony and arsenic.

Desilverizing:- The removal of silver with zinc.

Refining:- The removal of residual zinc.

Molding:- The casting of bars for shipment.

The treatment of by-products comprises:

Retorting:- To separate zinc from silver.

Cupelling:- To remove residual lead from silver.

Residue Furnace Smelting.
Blast Furnace Smelting:- Forretreatment of all other by-products to produce lead bullion or antimonial lead.

Tooele Bullion is received at the East Chicago Refinery in open gondola cars in the form of blocks which weigh 4 tons each. These blocks are unloaded by cranes and charged into 135 ton kettles for melting. Charges consisting of straight Tooele bullion is not decopperized at this plant as this operation is now carried out at the smelter. Other material such as East Helena bullion, Residue Furnace metal and Blast Furnace metal require decopperizing. This operation is done just prior to softening and is accomplished by means of sulphur whereby the copper is removed as a complex copper-sulphur dross.

Softening

By softening is meant the removal of arsenic and antimony from the lead bullion. This operation is carried out in 135-ton steel kettles. After charging, the kettles are heated until the temperature of the molten lead reaches about 1200°F; during the heating up operation 200 to 300 lb. of hydrated lime is shoveled onto the bath and the kettle covered with a hood to prevent dusting. When the kettle has reached the desired temperature a mixer is inserted and the lead blown with air for from 10 to 20 hours. At intervals and depending on the amount of antimony present in the bullion, the lime dross is skimmed off and a new charge shoveled onto the bath. Atthis temperature the antimony and arsenic oxidizes together with some lead and this in turn is absorbed by the finely divided lime on the surface of the bath. Near the end of the operation the metal is sampled frequently and when the antimony is shown to be reduced to less than about 0.10% the kettle is allowed to cooldown and the kettle is skimmed ready for desilverizing.

The skimmings which consist of a mixture of lead lime and calcium arsenate and antimonate are collected for further treatment as described below.

Desilverizing

The Desilverizing Kettles are circular welded steel kettles, 10' in diameter and 5' deep. Each kettle has a capacity of 135 tons of molten lead. The kettles [redacted] with their rims 18 inches above the floor level to facilita[redacted] on the surface of the molten metal. Each kettle is in a [redacted]tting and is stoker fired.

A kettle is filled with lead from the Softening Kettle and the dross blocks from the previous run are added and heated to the temperature of the lead. The block contains a large amount of metallic lead which is entrained in the mass of skim. This melts and 'liquates', out leaving the skim on the surface. The skim is of a mushy consistency and is removed and placed in a press which squeezes out the molten lead, leaving a dry crystalline dross, which is broken up.

After pressing, slabs of metallic zinc are added, allowed

to melt and the mixture of lead and zinc thoroughly stirred. For this purpose a mechanical stirrer with a motor driven propeller is lowered into the molten lead and run at moderate speed. This produces a rapid circulation of the metal. The zinc combines with the silver in the lead to form an alloy which has a higher melting point than pure lead. The kettle is slowly cooled to a temperature between the melting points of the lead and the zinc-silver alloy: the alloy therefore crystallizes out and rises to float as a crystalline dross on the surface. This dross, consisting of lead, zinc and silver, is skimmed off and cast into large blocks, which are returned to the next run as described above.

After this operation, the lead is free of silver but still contains approximately 0.55% zinc.

A vertical centrifugal pump is lowered into the kettle and the molten desilverized lead pumped down to the Refining Furnace for the next operation, which is the removal of the residual zinc.

Refining

The Refining Furnace is a coal fired reverberatory with a water-jacketed hearth 45'3" x 15'6" x 2'8" deep. A charge of 320 tons of lead is "cooked" in this furnace at a temperature of 1400°F for 12 hours. Air or steam is blown in to agitate the metal. The zinc, lead and the remainder of the antimony form a layer of mixed oxides on the surface which is skimmed off. When samples show that all zinc and other impurities have been removed, the refining of the lead is complete.

Molding

The refined molten metal is tapped from the Refining Furnace into a 135-ton holding kettle which is fired by a coal stoker. The metal is cooled to 780°F and held at this temperature during molding. From this kettle the lead is pumped to a Newnam casting wheel which carries 120 molds. This casting wheel is capable of molding 200 tons of pig lead in an 8-hour shift.

In the various steps of bringing the bullion to this point a series of by-products have been produced which are diverted for further treatment, as noted above. Of these the principal one is the zinc skim, containing practically all of the silver which was in the original bullion. The others contain the copper, antimony and arsenic from the bullion.

SILVER RECOVERY:

Retorting

The zinc skim after pressing out the lead is charged into retorts; the zinc is distilled off and condenses for re-use, leaving the lead and silver in the retort as "Retort Bullion". The retorts are bottle shaped graphite vessels 40 inches high and 19 inches in diameter. There are six retorts, each is mounted in a separate tilting furnace fired with gas. The retort is charged, a graphite condenser luted over its mouth and the temperature is raised to approximately 2000°F. As the zinc distills and collects in the condenser it is tapped out through a hole in the bottom and cast into slabs. When all zinc has been distilled off the condenser is removed, the retort is tilted and the bullion, containing the gold, silver and some lead, is cast into bars.

Cupelling

The next step is [redacted] of lead. This is done by cupellation, exactly as in [redacted] furnace. The cupel, called a "test bottom" is a shall[redacted], 4'6" x 6'6", made of limestone and cement. This is mounted in a rectangular furnace and is heated by oil burners directed down on its surface. The lead in the molten bullion oxidizes on the surface to form a slag of litharge which is skimmed off by tilting the hearth slightly. Jets of air are blown over the surface of the metal to hasten this oxidation. When all of the lead has been removed in this way the molten metal remaining consists of silver with a small amount of gold. This is cast into bars weighing about 1000 ounces and shipped to the Raritan Copper Works for final separation.

BY-PRODUCTS:

Residue Furnace Treatment

The various other by-products produced at different points may be grouped roughly into two classes;- Those which contain silver and copper and those which do not. The former are smelted in a coal fired reverberatory 36'9" x 8'6" x 2'8" deep, water jacketed, known as the Residue Furnace. The products are: Residue Bullion, containing the major part of the lead and practically all of the silver; Matte, containing lead, copper and some silver; and Slag, containing lead, antimony and arsenic with practically no silver. The refinery by-products contain no sulphur, and, since sulphur is required to form matte and separate the copper, a small amount of high grade Galena Ore is charged to supply this element.

The Residue Bullion is returned to the head of the process to be treated as new material. The matte is shipped to Tooele for retreatment and the slag is combined with other by-products containing no silver and sent to the Blast Furnace.

Blast Furnace Treatment

The Blast Furnace equipment consists of two circular furnaces 42" in diameter at the tuyeres and 14 feet from tuyere line to charge floor level. Each furnace has five 5" tuyeres. The crucible is mounted on trucks and is removable for relining, leaving the remainder of the furnace shaft suspended.

The charge is made up of various antimony bearing materials low in silver, with proper fluxes and coke for fuel. A charge weighs 3,000 pounds. Coke forms 8 to 14% of the charge. A high iron content is necessary to flux the zinc carried by the refining furnace skim.

The charge is made up by hand in a shallow pan resting on a multiple-beam platform scale. This pan is lifted by the crane and its contents poured into the top of the furnace.

The charge column is carried about 8 feet above the tuyere line, the blast pressure is 6 to 12 ounces.

The products are antimonial lead and slag. The lead flows continuously from syphon tap to a collecting mould which produces four ton blocks. These blocks are transferred to a one hundred ton kettle, where the antimonial lead is treated to remove arsenic and copper, and then cast into 70 pound bars.

Arsenic, with some lead and antimony, are carried off in the fume from both blast and residue furnaces. Gases from both furnaces are drawn through a brick and steel flue 680 feet long leading through an 8 foot, 50,000 cubic foot Sirocco Fan to the bag house.

The bag house is of brick and steel and is divided into four chambers, each containing 144 cylindrical woolen bags 18" x 32'. The bags are shaken by a mechanical shaking device. The bag house temperature is maintained at 150° F and the bags shaken at frequent intervals. There is no acid in the gases filtered and the bags have a long life.

The fume collects in concrete pits; it is removed by hand and smelted on the Residue Furnace or the Blast Furnace together with other by-products.

Non-Ferrous Production Metallurgy

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NEW YORK
JOHN WILEY & SONS, INC.
LONDON: CHAPMAN & HALL, LIMITED

1941

TABLE 57

EAST CHICAGO REFINERY

APPROXIMATE TONNAGES AND ANALYSES OF BULLIONS AND BY-PRODUCTS

(Per 1000 Tons of Bullion and 280 Tons Custom Materials Treated)

Material	Dry Tons	Per Cent. Pb	Sb	Cu	As	Zn	Bi	Fe	Te	SiO_2	FeO	CaO	ZnO	Sn	Ounces per Ton Ag	Au
1.* Tooele bullion	720	99.02	0.84	0.009	0.012	0.003	0.135	0.002	0.034						99.76	0.24
2. East Helena bullion	230	99.06	0.45	0.088	0.018	0.004	0.024	0.003	0.007						99.33	0.53
3. Dry drosses	99	69.20	5.70	2.30	1.32										26.10	0.06
4. Sulfur drosses	39	81.30	1.60	2.90											79.03	0.19
5. Lime skim	45	71.50	12.50	0.05	0.140										37.00	0.12
6. Zinc-silver crust	45	70.50	0.10	1.08		17.00									2000.0	11.25
7. Refining furnace skim	70	82.70	2.50		0.090	11.20									0.08	
8. Molding kettle skim	9															
9. Refined lead	1000	99.86	0.0006	0.001		0.001	0.102	0.004							0.23	
SILVER ROOM																
10. Blue powder	0.8	4.05				74.60									123.9	0.38*
11. Retort bullion	36	76.00	0.12	1.17											1300.0	15.50
12. Retort zinc	6															
13. Litharge	35	77.20	0.12												139.0	0.79
14. Doré bullion	3.5														(993.57 fine ozs)	3.18
RESIDUE FURNACE																
15. High antimony slag	125	56.10	14.50	0.20	0.75										1.40	
16. Reduction bullion	188															
17. Lead-copper matte	10	73.40	3.30	0.30				1.10							35.10	
MATTE CONCENTRATION																
18. Concentrated matte	3.5	28.10	0.75	14.12	0.22			25.80							23.00	
19. Slag	2.40	0.22	0.90													
20. Dressed metal	93.29	5.79	0.083												80.92	
BLAST FURNACE HARD LEAD																
21. Slag	2.00	1.80								23.90	37.40	16.40	9.2			
22. Speiss	6.00	26.00	0.80	12.00											0.80	
23. Antimonial lead																
MOLDING KETTLE HARD LEAD																
24. Dross	70.40	10.70	4.20	1.20						33.30	28.40	14.60				
25. Refined antimonial lead	83.60	14.60	0.002	0.13										0.31	4.20	
BLAST FURNACE SOFT LEAD																
26. Slag	2.30									26.10	37.40	13.0	12.0		4.30	
27. Matte																
28. COMPOSITE DUST AND FUME	53.70	0.30		1.70	5.70										3.30	

Courtesy International Smelting and Refining Co.

* The numbers are for the purpose of reference to the flow sheet on page 250.

with the calcium an intermetallic compound, which probably forms another ternary compound with bismuth and magnesium yielding a dross which may contain more than 5 per cent of the metal and a lead containing less than 0.05 per cent bismuth. The last traces of arsenic, antimony, silver, and copper are also removed by this treatment, although tin is not affected. By treating this dross again it can be concentrated up to 10 per cent of bismuth. Some residual calcium remains in the lead, depending partly upon the excess of calcium introduced as well as upon the solubility of calcium in the alloy at its melting point. This residual calcium, when present in amounts less than 0.05 per cent, serves to harden the bullion. It may easily be removed by blowing with steam, chlorine, or some oxidizing material, but usually the alloy itself can be marketed.

THE LEAD REFINERY OF THE INTERNATIONAL SMELTING AND REFINING COMPANY

324. General. This plant, located at East Chicago, Indiana, is one of the largest lead refineries in the United States. The East Chicago refinery refines bullion received from the Tooele, Utah, plant of the International Smelting and Refining Company and the East Helena, Montana, plant of the American Smelting and Refining Company. It also receives lead residues and drosses from the various plants of the Anaconda Copper Mining Company, of which it is a subsidiary, as well as some custom bullion and secondary materials. Tonnages and analyses of products are given in Table 57. The plant has an annual capacity of 84,000 tons, producing common desilverized pig lead, antimonial lead, and doré bullion. It is essentially a Parkes process plant. The flow sheet of the process is shown in Figure 66, the principal steps of which are given below.

325. Drossing and decopperizing. Tooele bullion is drossed and decopperized at the Tooele smelter prior to shipment to the refinery. All other bullion treated at the East Chicago Refinery is melted in welded steel kettles of 135 tons capacity, drossed, and decopperized by means of sulfur. The products are a copper dross and decopperized bullion.

326. Softening. The decopperized bullion is "softened" by the removal of antimony and arsenic. This operation is carried out in kettles of 135 tons capacity, hydrated lime being employed as reagent. The products are a lime skim and softened bullion.

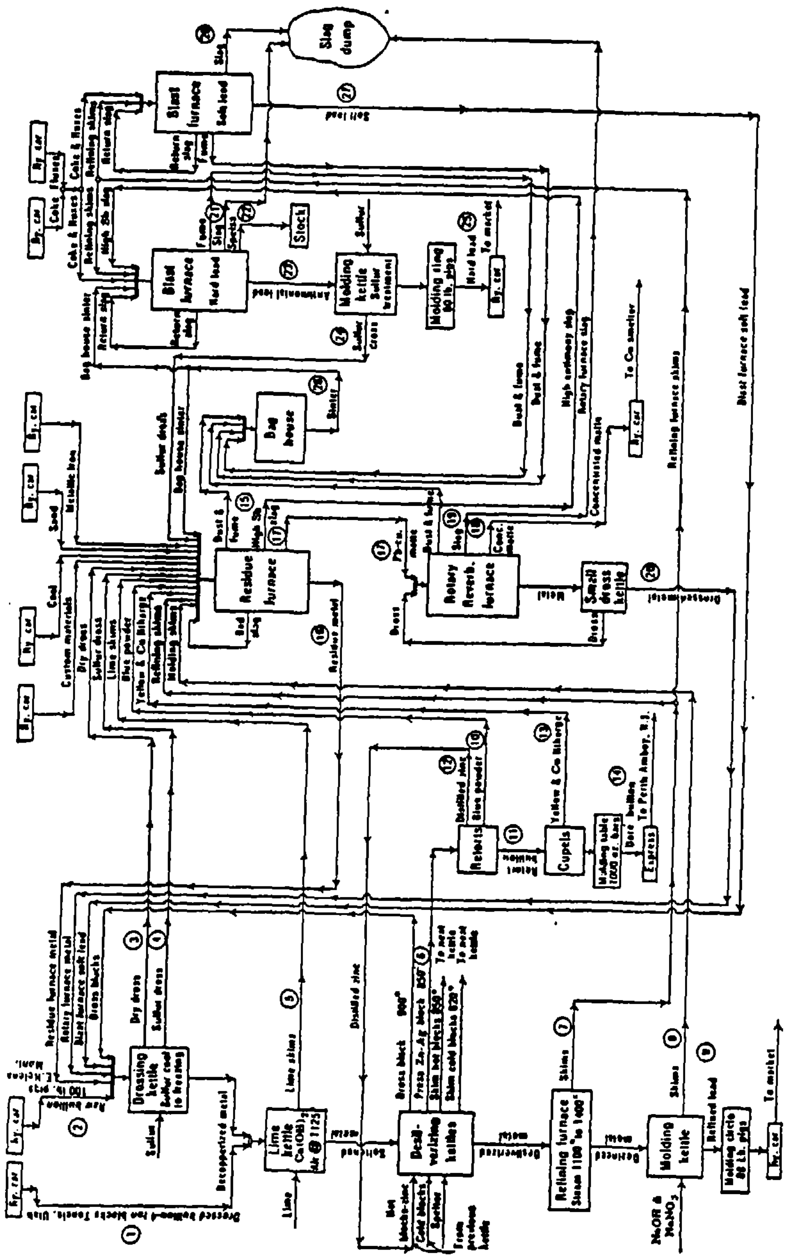


FIG. 66. The East Chicago Refinery. (*Courtesy Anaconda Copper Mining Co.*)

327. **Desilverizing.** The softened bullion is pumped to kettles of similar design and size for desilverizing with metallic zinc. The products are a zinc-silver-gold dross and desilverized lead.

328. **Refining.** The desilverized lead is pumped from the silver kettles to a coal-fired reverberatory furnace (capacity 330 tons) for refining. Residual zinc and antimony are removed from the lead by means of air and steam at a temperature of approximately 1300°F. The products are refining furnace skim and refined lead.

329. **Molding.** The refined lead is drawn off from the refining furnace into a 250-ton welded steel kettle, from which it is pumped to a horizontal Newnam-type molding machine (capacity 200 tons per 8 hours), where the lead is cast into 90-pound pigs ready for market.

330. **Residue Furnace.** All silver-bearing refinery by-products are smelted in a reverberatory furnace, 30 feet by 9 feet by 2 feet, 8 inches, for the separation of silver and antimony. This treatment produces a silver-free, antimonial-lead slag and a low-antimony, silver-bearing bullion; some copper matte is also formed. The bullion is returned to the head of the refining system for retreatment along with regular bullion. The slag is transferred to the blast furnace for treatment. The matte is treated in a rotary, reverberatory furnace to concentrate the copper, and the concentrated matte shipped to the Tooele, Utah, plant for retreatment.

331. **Blast Furnace.** The antimonial-lead slag produced in the residue furnace is treated in a small blast furnace together with other silver-free lead materials to produce an antimonial lead and a waste slag which is sent to the dump. From time to time, various refractory silver-bearing materials are worked up in a soft-lead blast furnace, the bullion thus produced being returned to the refining system and the slag sent to the dump.

332. **Retorting and Cupelling.** The zinc-silver-gold dross produced in the desilverizing operation is retorted for recovery of the contained zinc, which is re-used in the process. The lead-silver retort bullion is then cupelled for the removal of lead as litharge. The doré bullion is cast into bars weighing 1000 troy ounces each and shipped to the Perth Amboy plant of the International Smelting and Refining Company, where it is parted. The litharge is returned to the residue furnace for retreatment.

333. **Fume Collection.** Fume from the residue, rotary furnace, and blast furnaces is collected in a four-compartment brick bag house containing 576 woolen bags each 18 inches in diameter by 30 feet long.

The fume is removed periodically from the bag house pits and returned to the residue or blast furnace for smelting.

HYDROMETALLURGY OF LEAD

334. **General.** The successful reduction of lead in either the ore hearth or the blast furnace requires an ore or concentrate containing 30 to 60 per cent of lead. Most of the lead ore now being mined is of low grade, about 6 to 10 per cent of lead, which cannot be economically smelted by pyrometallurgical methods. It follows then that some hydrometallurgical method would dispense with the inefficient concentration process and the costly smelting step and produce lead cheaply, directly, and quickly. Unfortunately research has failed so far to produce any such process that can compare with the successful leaching methods already developed for the recovery of zinc, gold, silver, or copper. Many are in the experimental stage, but few have passed beyond the small plant of fifty tons daily capacity.

Besides the low-grade lead ores, there are a great many other materials adapted to this sort of treatment. Electrolytic zinc-plant tailings often contain lead and small amounts of gold and silver. These are too low-grade for treatment in a blast furnace, nor can they be successfully cyanided for the precious metals. The fact that the grinding has already been done in connection with the recovery of zinc renders them particularly attractive for a leaching treatment. Flue dust from lead and zinc smelters is not well suited to smelting owing to its chemical composition as well as its physical make-up. Ores of lead containing the sulfate or carbonate are difficult to concentrate owing to the brittleness of the minerals and to the fact that they are not amenable to the flotation process. Tailings from old concentration plants being in a fine state of subdivision and partly oxidized offer an admirable product for leaching.

335. **Conversion to Soluble Form.** Most of our lead is derived from sulfide ores, but so far no suitable reagent has been found for dissolving this lead sulfide directly—at least none cheap enough for commercial use. It is necessary to convert this lead into some more soluble form—either the sulfate, carbonate, or chloride—before leaching. The sulfate and chloride are soluble in brine, the carbonate in acidified brine.

Sulfide ores can be easily and quickly converted to the sulfate by a carefully controlled, low temperature roast (400° to 550°C.) Sulfuric acid treatment has been suggested for the sulfate, whereas chloridizing

may be carried out by roasting the ore in the presence of salt or by treatment with hydrochloric acid or ferric chloride.

336. **Leaching.** Lead chloride, lead sulfate, and silver chloride are dissolved by a neutral saturated solution of sodium chloride or a strong solution of calcium or magnesium chloride. Some processes use a little excess chlorine and, where silver chloride is being leached, it is necessary to add ferric chloride or acid to dissolve any metallic silver or sulfide which may be precipitated by other sulfide minerals.

337. **Precipitation.** Sponge iron will precipitate lead from brine solutions at ordinary temperatures. Electrolysis with both soluble and insoluble anodes has been tried. Chemical precipitation with zinc hydroxide, sodium carbonate, or sodium sulfide has been tried also, but at the present time the commercial plants are using either electrolysis or sponge iron.

THE TAINTON PROCESS

338. **Roasting.** This process of brine leaching, developed in 1923 at the Bunker Hill and Sullivan Mining Company in Idaho, has undergone extensive experimentation for several years. The galena is roasted to a sulfate in an electrically heated, rotary kiln at a temperature of about 500°C. Electricity is used as a source of heat because the atmosphere and temperature can be more easily controlled and maximum formation of sulfate assured.

339. **Leaching.** Water is used to remove the soluble sulfates of manganese, magnesium, and other metals. Lead and silver sulfate being insoluble are not dissolved, and if copper is present it can be recovered by precipitation on scrap iron. Leaching is done by agitation with a saturated brine solution containing some free chlorine obtained from the electrolytic cells. The pulp is thickened, filtered, and washed (calcium chloride is added to the clear solution to remove the excess of sulfuric acid as calcium sulfate), leaving a chloride solution of lead, silver, etc.

340. **Electrolysis.** This solution is electrolyzed at a high current density and high acid strength between rotating sheet-iron cathodes and graphite anodes. The sponge lead thus recovered is thrown off the cathode by centrifugal force, floats out of the cell with the brine, or settles to the bottom, and is removed and pressed into cakes for melting. The chlorine gas evolved is passed through scrubbing towers whereby it is converted either to the chloride for use in the process or to the hypochlorite.

mining costs were 69.52c. per ton, including 17.72c. for development. The combined working cost at the mines per ton of ore was 23.04c.; to this is added 9.8c. for development and prospecting, including 7.5c. for fixed charges for stripping, making total mining costs 32.88c. per ton.

Both mills will be finished when a small amount of construction work now underway is completed. The Magna plant treated 4,142,700 tons and the Arthur plant 3,376,692 tons, a total of 7,519,392 tons of ore milled. The average grade of this ore was 1.25% compared with 1.36% in 1912. It is stated that this decrease was due to mining a large percentage of low-grade ore from the northern limits of the deposit. The average mill recovery at the Magna plant was 63.78% and at the Arthur plant 64.18%. The average for both was 63.95%, or 15.95 lb. of copper per ton of ore. The final recovery in refined copper was 15.2 lb. per ton of ore. The cost of milling at the Magna plant was 35.59c. and at the Arthur plant, 38.20c.; the average for both plants was 36.76c. per ton.

The ore reserves were increased 16,000,000 tons in addition to the tonnage mined and estimates at the end of the year indicate 332,500,000 tons of ore averaging 1.47% copper. The capacity of the mills on normal-grade ore is about 21,000 tons a day.

Operating costs and other expenditures and receipts may be summarized as follows:

Total tons of ore treated		7,518,892
Copper produced, pounds		113,942,834
Net yield in pounds of copper per ton ore		15.2
	Amount	Per Lb. Cu.
Operating expenditures:		
Mining and milling	$4,553,222	4.00c.
Treatment and refining	6,086,880	5.34c.
Selling commissions	170,636	0.15c.
Stripping ore	563,954	0.50c.
Mine development	119,649	0.11c.
Total operating expense as charged	$11,494,341	10.10c.
Less gold and silver contents	732,583	0.65c.
	$10,761,758	9.45c.
Less other operating income except Nevada Consolidated dividends	270,547	0.24c.
	$10,491,211	9.21c.
Interest paid	60,319	0.05c.
Net operating total	$10,551,530	9.26c.
Spent on deferred operations	1,493,242	1.31c.
Spent on plant and equipment	$17,428	0.72c.
	$12,862,200	11.29c.
Less receipts from stock transactions and decrease in investments	272,378	0.24c.
	$12,589,822	11.05c.
Less Nevada Consolidated dividends	2,001,000	1.76c.
	$10,588,822	9.29c.
Receipts from copper produced	17,063,635	14.97c.
Net balance over expenditures	$6,474,813	5.68c.

Salt Production in the United States in 1913 amounted to 14,299,298 bbl. of 280 lb., according to the U. S. Geological

Engineering & Mining Journal, Vol 98, 8/8/14, pages 270-272

International Lead Refining Plant*

The Parkes-process lead refinery of the International Lead Refining Co., at East Chicago, was built to treat the lead bullion produced by the Tooele plant, Utah. Ground was broken Apr. 16, 1912, and exactly six months later the plant was in operation and lead was being cast. The capacity of the plant running 25 days per month is 5000 tons. The four products of the plant are: Common, corroding and antimonial lead, and doré bullion.

The plant is so arranged that all the principal operations are performed in one main building. This is a steel and concrete structure, 480x180x50 ft. Three broad-gage railway tracks enter the building, and two 15-ton electric cranes, one 28-ft. and one 77-ft. span, travel the entire length.

The main battery consists of the following apparatus:

	Capacity Tons
Two sample kettles	45
Two liquating kettles	60
Two softening furnaces (inside dimensions, 13 ft. 6 in. by 28 ft. 2 in. by 2 ft. 7 in. deep)	300
Two desilverizing kettles	100
One refining furnace	300
One molding furnace	200

INTERNATIONAL LEAD REFINING CO.'S PLANT, EAST CHICAGO, IND.

Flue in foreground, baghouse at right. View from opposite corner.

The arrangement is such that the lead flows by gravity from one piece of apparatus to the next and is finally hand-molded and loaded by trucks into cars.

For the treatment of byproducts resulting from the main refining operations, the following equipment is provided:

	Capacity
Three residue furnaces, each 8x16 ft. by 20 in. deep (inside measurement)	30 tons each
Two circular blast furnaces, each 42 in. in diameter at tuyeres by 14 ft. high, with five 3-in. tuyeres	40 tons each
Eight retort furnaces	1200 lb. each
Two tilting cupels, Rhodes type	5 tons each

Common lead is further refined to yield a product suitable for corroding by the Hulst crystallizing process. The equipment of this department consists of the following:

	Capacity
Two crystallizing kettles	60 tons
Four heating kettles	20 tons
One press	

Gases from the cupel, residue and blast furnaces are conducted through brick and steel flues to a single bag house. The bag house is a building of brick and steel, 50x65x50 ft. The interior is divided into four separate chambers, each containing 144 woolen bags, 18 in. in diameter and 30 ft. long. The bags are shaken by an electric driven automatic shaking device. The gases are delivered to the bag house by an 8-ft. American Blower Co. fan, driven by a 35-hp. motor.

*An abstract for a paper by G. P. Hulst, read at the Salt Lake meeting of the A. I. M. E.

The change house is a brick building, 35x85 ft. It is equipped with sanitary toilets, wash basins and lockers. One room is arranged as a lunchroom for the men. The offices and laboratory are housed in a brick building 36x128 [illegible].

Lead bullion from Tooele containing about 99.5% lead, 65 oz. silver, 0.4 oz. gold, and varying amounts of copper, antimony, arsenic, zinc and bismuth, is received at the refinery in sealed cars and after being weighed is delivered into the softening furnaces by means of a steam-driven conveyor, constructed by Howe Scale Co. The sides and ends of these softening furnaces are water jacketed from the base plate to 3 in. above the slag line.

The products of the softening furnace are first skims; second skims and softened bullion. The first two are sent to residue furnace No. 1. The bullion flows to the desilverizing kettles. The copper skimmings are charged into the softener. In the desilverizing kettle bullion is treated with zinc and skimmed, yielding zinc skims and desilverized lead.

The zinc skims go to the retorts and the desilverized lead to the refining furnace. The products of the refined furnace are lead-zinc oxide, refinery skim and refined lead. The first product, depending on its composition, is treated in one of the residue furnaces or in the blast furnace. The skimmings go to residue furnace No. 3. The refined lead, in part, goes to the Pattinsonizing kettles for further treatment, and the remainder passes to the molding furnace.

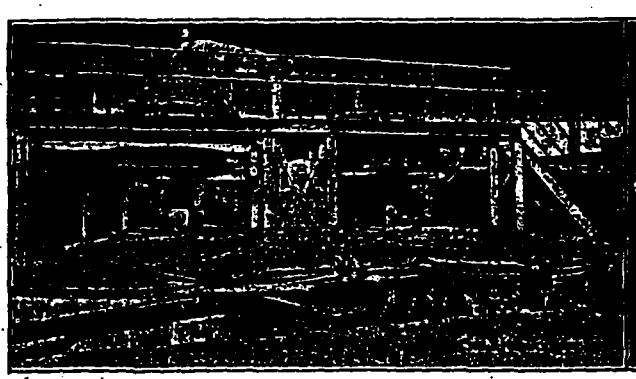
At the molding furnace the lead is siphoned into molds arranged in the arc of a circle, as shown. The bars are removed from the molds and stacked by hand and are placed in stock ready for shipment.

In the treatment of byproducts, the zinc skim produced at the desilverizing kettles is treated in four tilting retort furnaces, using oil as fuel. The products of this operation are retort zinc, retort breakings, blue powder and retort bullion. The retort zinc is returned to stock to be used again at the desilverizing kettles. Retort breakings are sent to the ore blast furnace. Blue powder is shipped to zinc smelters for treatment.

The retort bullion passes to two Rhodes-type cupel furnaces. These produce test breakings, copper litharge, yellow litharge and doré bullion. The test breakings go to the ore blast furnace, the two litharge products go to residue furnace No. 2 and the doré bullion is molded into anodes and shipped to the Raritan Copper Works for refining. The Pattinsonizing kettles are equipped for the Hulst crystallizing process.

The lead received at the kettles from the refining furnace contains from 0.08 to 0.12% Pi. One crystallization reduces the bismuth from 0.08 to 0.05% and less. For lead containing 0.12% Bi, two crystallizations are necessary, if the crystals are drained by gravity; one is sufficient if crystals are pressed. With such a low-grade product subsequent treatment for the recovery of bismuth is not profitable. This department will produce 150 tons of refined corroding lead per day, with a bismuth content of 0.05% or less.

Residue furnace No. 1 receives sample-kettle dross, softening-furnace skims, flue dust from all sources and galena (80% Pb). The charge is weighed in over a small



LEAD KETTLES

MOLD RING FOR REFINED LEAD

ZINC-CRUST DISTILLATION FURNACES

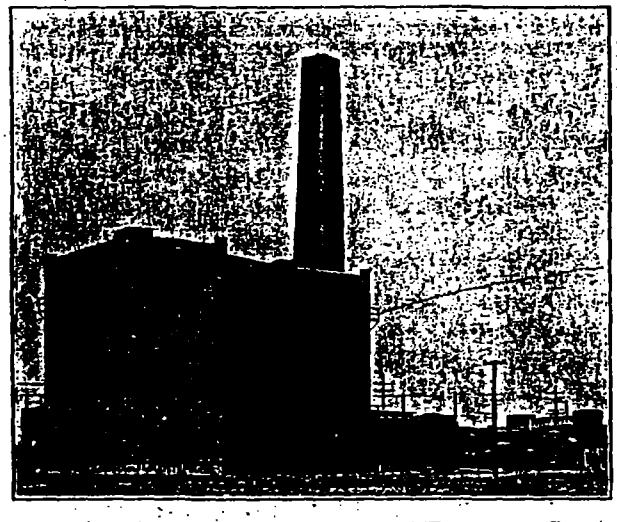
CUPELING FURNACE

charging scale, and is so proportioned as to yield products of fairly constant composition. The products are bullion, refinery matte and antimonial slag. The bullion is returned to the softening furnace. The matte is shipped to the smelter for treatment and the antimonial slag goes to the antimonial blast furnace.

Residue furnace No. 2 receives only the litharge products from the cupel furnaces and galena. Its products are bullion, slag and refinery matte. The bullion is returned to the softening furnace, the slag goes to the No. 1 residue and the refinery matte is shipped to the smelter.

Residue furnace No. 3 treats the skimmings and dross from the refining furnace and from the Pattinsonizing kettles. These yield lead and skimmings. The former goes to the refining furnace, the latter to the antimonial blast furnace.

The ore blast-furnace charge is made up of lead ores, coke and flues, and the following byproducts: Retort breakings, test breakings and slag from residue furnace No. 3. The three products are slag, matte and bullion.



BAGHOUSE, INTERNATIONAL LEAD REFINING CO.

The slag goes to the dump, the matte is shipped to the smeltery and the bullion is returned to the softening furnace.

The antimonial blast-furnace charge consists of ore, coke and fluxes, and, in addition, antimonial slag from residue furnace No. 1 and skimmings from residue furnace No. 3. The charge weighs 1450 lb. The coke used is 12% of the weight of the charge. The products are slag, matte and antimonial lead. If no ore is used, the charge contains no sulphur and no matte or speiss is formed. The charge is carried low in the furnace under a light blast pressure (5 to 6 oz.). Arsenic is burned off and recovered in the flues and bag house.

The slag produced is sent to the dump. It has the following analysis:

	Per cent.
SiO_2	24.0 to 26.0
Al_2O_3	10.0
FeO	36.0 to 38.0
CaO	10.0 to 12.0
ZnO	12.0 to 14.0
Pb	1.5 to 2.0

Matte, when produced, is shipped to the smelter.

The antimonial lead is run to a liquating kettle, from which it is cast into bars for shipment. Consumers of this product commonly specify that the lead should contain: Antimony, 15 to 18%; arsenic, less than 1%; copper, less than 0.5 per cent.

July Mining Dividends

Thirty-five mining companies making public reports paid $7,654,337 in dividends in July, as against $7,234,529 paid by 38 companies a year ago. Steel, smelting and holding companies paid $3,320,245, a variation of a few dollars only; and Mexican and Canadian companies paid $1,605,950, as compared with $3,107,528 last year.

Company	Situation	Per Share	Total
Ahmeek	Mich.	$2.00	$100,000
Arizona, c	Ariz.	0.24	360,235
Anaconda, c	Mont.	0.75	3,474,275
Argonaut, g	Calif.	1.50	300,000
Kendall, g	Mont.	0.06	30,000
Brunswick, g	Calif.	0.06	23,717
Bunker Hill & Sullivan, l.s	Ida.	0.25	81,7500
Bunker Hill, g	Calif.	0.02	10,000
Camp Bird, pf. g	Colo.	0.17	100,565
Continental, s	Mo.	0.50	11,00[illegible]
Center Creek, s	Mo.	0.05	5,000
Daly Judge, s. l	Utah	0.15	45,000
Fremont, g	Calif.	0.02	4,000
Golden Cycle, g	Colo.	0.03	45,000
Hecla, l. s	Ida.	0.02	20,000
Homestake, g	So. Dak.	0.65	163,254
Iron Blossom, s. l. g	Utah	0.10	100,000
Mary McKinney, g	Colo.	0.02	26,185
North Butte, c	Mont.	0.50	205,000
Old Dominion Cop. M. & S. Co., c	Ariz.	1.25	202,500
Osceola, c	Mich.	1.00	96,150
Pittsburgh-Silver Peak, g	Nev.	0.02	55,800
Portland, g	Colo.	0.04	120,000
Ray, c	Ariz.	0.37$	543,964
Silver King Con., s	Utah	0.10	62,000
Shattuck-Arizona, c	Ariz.	0.50	175,000
Tonopah-Belmont, g.s	Nev.	0.25	375,000
Tonopah Extension, g. s	Nev.	0.05	70,769
Tonopah Mining, g. s	Nev.	0.05	250,000
Utah Consolidated, c	Utah	0.50	150,000
United Globe, c	Ariz.	4.00	92,000
Vindicator, g	Colo.	0 03	45,000
Wasp No. 2, g	So. Dak.	0.01	5,000
Tom Reed, g	Ariz.	0.06	54,573
United Verde, c	Ariz.	0.75	225,000
Yellow Aster, g	Calif.	0.03$	5,000
Yosemite, g	Calif.	0.01	2,400

Iron, Industrial and Holding Companies	Situation	Per Share	Total
Am. Smelter's Sec., pf. A	U. S.	$1.50	255,000
Am. Smelter's Sec. pf. B	Mex.	.125	375,000
Bethlehem Steel	sess.	1.25	188,350
Cambria Iron	Penn.	2.00	169,360
Guggenheim Expl	U.S., Mex.	0.87$	727,768
Old Dominion, c	Ariz.	1.00	293,353
Penn. Salt	Penn.	3.00	160,000
Republic Iron & Stee	U. S.	1.75	357,296
Sloss-Sheffield, s. & I	Ala.	1.75	117,250
U. S. Sm., Ref. & Min., com	U. S.	0.75	263,332
U. S. Sm., Ref. & Min., pfd	Mex.	0.87$	425,536

Canadian, Mexican and Central American Companies	Situation	Per Share	Total
Beaver, s	Ont.	0.03	59,989
Buffalo, s	Ont.	0.05	50,000
Canadian Goldfields, g	B. C.	0.0011	50,000
Con. Min. & Sm.	B. C.	2.00	116,088
Crown Reserve, s	Ont.	0.02	35,376
Hollinger, g	Ont.	0.15	90,000
La Rose, s	Ont.	0.25	374,656
Lucky Tiger, g. s	Mex.	0.09	64,380
McKinley-Darragh, s	Ont.	0.06	134,861
New York & Honduras Rosario, g	C-A	0.30	60,000
Nipissing, s	Ont.	0.25	300,000
Nova Scotia, S. & C., pf	N. S.	2.00	20,600
Nova Scotia, S. & C., com	N. S.	1.50	90,000
Porcupine Crown, s	Ont.	0.03	60,000
Standard, s. l	B. C.	0.02$	50,000
Trethewey, s	Ont.	0.05	50,000

Dividends for the first seven months of the year are: Mining companies, $40,580,220 in 1914; $45,450,722 in 1913; metallurgical and holding companies, $45,034,348 in 1914; $44,449,761 in 1913; Canadian, Central American and Mexican companies, $11,500,862 in 1914; $13,879,295 in 1913.

An Ingenious Smoke and Fume Recorder is described in "The Electrician," June 5, 1914. It appears that flue gases are highly ionized when free from smoke and solid fume. Where these are present ionization falls off. Spark gaps are arranged inside and outside the stack. If fume is present the discharge takes place outside, and actuates a bell by means of a coherer.

indicated that it would have paid to start a new hole and wedge whenever the deflection exceeded 3°. The upper part of the hole was a fissured granite or gneiss; the lower, fissured quartzite. The first wedgings were expensive and only partly satisfactory but a skilful setter and crew corrected the difficulties, making accurate wedgings without difficulty after the third wedging. The average correction per wedge was 2°. Two subsequent holes in norite, greenstone, and granite were drilled to depths of over 2500 ft. (762 m.), keeping the deflection within 5° by using three wedges in each. One of these holes had deflected to 5° at a depth of 362 ft. (110 m.). It was wedged at 328, 472, and 580 ft., bringing it back to 1° 10′. The other was out 2° 25′ at a depth of 700 ft. A wedge brought this back to 0° 35′. Though new to the work the setters and crews on the latter holes had no difficulties. Thin core shells being lowered to recover lost cores should be lowered slowly past the top of a wedge. The first deflecting wedges were made without the extra foot of the base and one gave trouble by loosening.

A set of wedges, comprising a drive, a pilot, and a deflecting wedge, cost about $25 in 1918. The average cost of a wedging was about $250, labor $100, fuel $50, carbon $50, wedges $25, and miscellaneous $25. Experienced crews took five shifts to complete a wedging, a shift placing a wedge, one shift drilling with "E" bit, two shifts reaming "E" hole to "A" size, one shift reaming through the wedge with the "A" bit.

Credit for the many suggestions is due the members of the firm of Smith & Travers, contractors. A successful wedging method, in addition to overcoming curvature, can be used to branch a hole for any purpose, for securing additional records of strata or additional samples of the vein or deposit. The application of wedging to the correction of curvature appears to overcome one of the large limitations of the diamond drill.

Bulletin of the American Institute of Mining and Metallurgical Engineers, 9/19, p. 1603-1604

TRANSACTIONS OF THE AMERICAN INSTITUTE OF MINING A. METALLURGICAL ENGINEERS [SUBJECT TO REVISION]

Treating Antimony Ores

BY GEORGE P. HULST,* EAST CHICAGO, ILL.

(Chicago Meeting, September, 1919)

PRIOR to 1914, there was little demand for antimony in this country; its use was limited almost entirely to the manufacture of type and bearing metals. Practically no antimony ore was mined here, the market being supplied principally from China, and the alloy was produced by a direct mixing of lead and antimony. The great world war, with its demand for shrapnel in hitherto undreamed of quantities, precipitated a great boom in the price of antimony. Nominally quoted at 6 c. to 7 c. in 1914, the price increased by leaps and bounds to 45 c. in March, 1916. Under the stimulus of high prices many small mines were opened, for it became profitable to work ores containing as low as 20 per cent. antimony. High-grade sulfide ores (stibnite), containing 55 per cent. to 60 per cent. antimony, were received from Bolivia, China, and Alaska. Low-grade sulfide ores, running from 20 per cent. to 45 per cent., were produced in Nevada, California, Idaho, Utah, and Mexico; much of this ore was fairly rich in silver. The principal oxide ores came from Mexico and Oregon. The following analyses are representative of various types of antimony ore:

	Sb	Pb	Cu	Ag	Au	SiO_2	Fe	S	CaO	Zn	As
Oxide ore.....	25.09					46.02	0.95	0.40	10.98	0.30	0.22
Sulfide ore.....	55.20					15.12	1.05	19.87		0.40	0.25
Sulfide ore.....	37.16	11.30	0.10	34.0		7.00	0.50	17.05	7.40	0.36	0.10
Sulfide ore.....	41.55	18.00	0.20	76.0	0.04	5.60	0.25	18.17	0.85	0.25	0.10

The International Lead Refining Co. fortunately was equipped to handle these ores through residue and blast furnaces. The charge consisted of a variety of sulfide ores containing Sb 20 to 60 per cent. and SiO_2 6 to 45 per cent., oxide ores containing Sb 20 to 40 per cent. and SiO_2 10 to 45 per cent. Secondary materials, such as battery plates, battery mud, lead oxide, paint, etc., together with refinery skims, softener skims, and other refinery byproducts, were treated along with the antimony ore to furnish the lead required. All silver-bearing antimony ores were treated in the residue furnace, the sulfur, iron, and copper forming matte that carried part of the silver, the balance going into lead bullion. The

* Assistant General Manager, International Lead Refining Co.

antimony slag produced was sufficiently low in silver to warrant being smelted in the blast furnace to antimonial lead.

The blast-furnace equipment consisted of two, five-tuyere, 42-in. round furnaces connected by flue to the bag house. On account of high zinc and arsenic in lead refinery byproducts, we ran a slag of the composition: SiO_2 26 per cent., FeO 40 per cent., CaO and ZnO combined 20 to 24 per cent. Net profit rather than metallurgy prompted a slag as low as possible in antimony even though the lead content was increased. Average analysis of slag for 6 mo. showed Sb 0.66 per cent. and Pb 2.36 per cent. Actual blast-furnace loss was 2.4 per cent. antimony and 1.503 per cent. lead. Due to sulfur and arsenic on the charge, some speiss was produced. The furnace charge varied from 2500 to 3000 lb. Coke ratio was 13 per cent. Blast pressure was maintained at 10 to 12 oz. The two furnaces smelted 60 to 90 tons of lead and antimonial material per day, producing 30 to 35 tons of antimonial lead of the following average analysis, Sb 13.00 per cent., Cu 0.15 per cent., As 0.75 per cent., Pb 86.1 per cent.

\CTIONS OF THE AMERICAN INSTITUTE OF MINING AND METALLURGICAL ENGINEERS [SUBJECT TO REVISION]

A Hot-wire Anemometer with Thermocouple

BY T. S. TAYLOR,* PH. D., EAST PITTSBURGH, PA.

(Chicago Meeting, September, 1919)

THE development of the linear hot-wire anemometer has been chiefly due to the efforts of L. V. King[1] and A. E. Kennelly and H. S. Sanborn.[2] The anemometers used by these investigators consisted essentially of a fine heating wire having attached leads for resistance measurements at distances of 10 or more centimeters from each other. In using such an anemometer, the current is measured that is necessary to maintain the resistance of the wire, between the two leads, constant for different air velocities. This resistance is always so chosen that the temperature of the heating wire will be sufficiently high to make the observations practically independent of small variations in the temperature of the gas in which the anemometer is placed. The measurement of the resistance of the anemometer wire requires a Kelvin bridge set up, which for commercial work is not altogether desirable. The cooling effect due to different air velocities depends on the temperature difference between the wire and the gas and the total quantity or mass of gas passing the wire per unit time. Since the temperature of the wire is maintained constant, the effect observed in the change in the heating current for a given change in air velocity is a measure of the difference between the gas flow in the two cases. Such an anemometer, therefore, measures the average gas flow for a length depending on the distance between the two resistance leads. Therefore the instrument in the form used thus far is not very satisfactory for measuring gas velocities in small tubes or in places where the velocity varies rapidly across the line of flow.

For the purpose of measuring gas flow through relatively small tubes, where the velocity changes rather rapidly across the tube, the hot-wire anemometer has been modified in the manner shown diagrammatically in Fig. 1. It consists essentially of a platinum heating wire H about 0.007 in. (0.178 mm.) in diameter and ½ to 1 in. (12.7 to 25.4 mm.) long stretched across a suitable framework, say of glass. This wire has

* Research Physicist, Westinghouse Research Laboratory.

[1] L. V. King: Roy. Soc. London, *Phil. Trans.* (1914) A 214, 373–432. Roy. Soc. London, *Proc.* (1914) A 90, 563–570.

[2] A. E. Kennelly and H. S. Sanborn: Amer. Phil. Soc., *Proc.* (1914–15) 53, 55–77,

are caught in these bags, from which they are shaken by reverse air current into pits beneath the bag chambers. From these pits, the fume is removed periodically and either returned to the first-sinter charge or sold to some of the other smelters that have plants in the Salt Lake valley.

The hot matte from the blast-furnace forehearths is taken to the converting plant, where it is poured into 96x150-in. horizontal, barrel-type converters. To these converters, silica is added to flux the iron, during which operation almost all of the lead is blown off in the form of a basic lead-sulphate fume. After the slag is skimmed off, a "white metal" remains, containing about 60 to 65 per cent copper. This "white metal" is transferred from the lead converter into another similar converter containing reverberatory copper matte, where it is blown to blister copper.

The gases from the converter, carrying the lead fume, pass through hoods into a long, steel flue connected to a baghouse. In this steel flue these gases are sufficiently cooled, and their acid content is neutralized, by the addition of fine, dry lime, so that they may be successfully handled in the baghouse. This converter baghouse is of similar construction to the blast-furnace baghouse described in the foregoing, excepting that it is smaller, containing only 960 woolen bags. Lead fume recovered from this baghouse is treated or shipped to other smelters, in the same manner as the blast-furnace baghouse fume.

The high iron slag produced from this converting operation, which contains between 2 and 3 per cent copper, is granulated and treated at the sintering plant, where it is found to be a first-class sinter-making material.

Drossing and casting of furnace lead is done in a new plant put into operation on Feb. 1, 1929. Kettle equipment consists of four 60-ton, cast-steel kettles and two 120-ton kettles. The lead is handled from the blast furnaces to the 60-ton kettles in three-ton ladles by a five-ton, monorail crane. The 120-ton kettles are used for storage, decopperizing, and casting. As a matter of fact, the drossing operation is really the first step in the refining of furnace lead, and its main purpose is the removal of copper.

The heavy dross is separated from the lead in the 60-ton kettles by the usual means of cooling and air agitation. This dross is skimmed by hand from the top of the lead bath into a large dross-basket, with perforated sides and bottom, which is immersed in the lead bath. This basket will hold 6,000 to 7,000 lb. of dross. After being filled with dross this basket is lifted out of the kettle by the monorail crane and held above the kettle until the molten lead has almost completely drained out through the perforations in the basket. The basket containing the dross is then carried outside of the building, where the dross is dumped onto a sloping, elevated platform on which it is cooled with water sprays and then scraped through grizzlies into a railroad car spotted beneath. This dross is quite "dry" (free of metallic lead) and is consequently of such fineness and physical character as to be readily handled through one of the regular blast-furnace bins to the charge cars.

After the heavy dross is removed from the 60-ton kettles, the lead is pumped to one of the 120-ton kettles for storage. After one of these large kettles is filled, and a light dross, which accumulates during the filling process, has been removed, further decopperizing is done by stirring crude sulphur into the lead bath under proper temperature conditions. This final decopperizing operation completes, as nearly as is possible with such a process, the removal of copper from the furnace lead, which was started by the drossing operation. With furnace lead containing about 2½ per cent copper, a cleaned lead is produced containing only 0.001 per cent or less of copper.

After the light dross from this final decopperizing operation has been skimmed off, the lead is pumped into steel molds, each of four tons' capacity. After a kettle full of lead has been cast, the blocks are sprayed with water to hasten cooling and solidification, after which they are lifted from the molds with tongs, by an overhead traveling crane, and loaded into flat-bottom, railroad cars.

With this new plant and method for handling lead and dross, it is possible to deliver, dross, decopperize, cast, and load at least 250 tons of lead per day with a crew of fifteen men.

With the loading of the lead blocks into railroad cars, the last step in this lead-smelting operation has been taken. After shipments to East Chicago, Ind., this lead is refined at the plant of another of Anaconda's subsidiaries, the International Lead Refining Company, whose operations are separately described by Mr. Johnson in the following article.

Western Lead Refined at East Chicago by Parkes Process

By G. E. JOHNSON
Superintendent, International Lead Refining Company

BULLION refined by the International Lead Refining Company, at East Chicago, Ind., is received from the International Smelting Company, Tooele, Utah, and the American Smelting & Refining Company, East Helena, Mont. To some extent the refinery is a custom refiner of lead bullion. Lead residues and drosses from all plants of the Anaconda company are treated, and limited quantities of scrap battery plates, lead drosses, and secondary materials are purchased.

The plant is a Parkes process lead refinery of 96,000 tons' annual capacity, producing common desilverized pig lead, antimonial lead, and doré bullion. A description of the plant and operations was presented by G. P. Hulst at the Salt Lake meeting of the American Institute of Mining Engineers, August, 1914. (*Trans.* A.I.M.E., Vol. 49, p. 532, 1915.)

The lead refinery is the original plant, and represents the major operation conducted at East Chicago. The site is an area of 32 acres, 20 acres of which is utilized for the refinery operation; the remainder is divided equally between the Anaconda Zinc Oxide Department and the Anaconda Lead Products Company.

At the refinery the principal operations are performed in one main building of all-steel construction, 480x180x50 ft. Separate buildings are provided for the general office, engineer's office, laboratory, research department, storeroom and shops, change house, and mess hall. The width of the main refinery building is divided into three bays, extending the entire length of the building. Two of the bays are spanned by three fifteen-ton electric cranes, two of 28-ft. span in one bay, and one of 77-ft. span in the other, which travel the length of the building and serve all departments. Three standard-gage railway tracks enter the building on different levels. The general arrangement of the furnaces and kettles permits the flow of most of the metal by gravity from bullion to refined metal.

Gases from the residue and blast furnaces are drawn through brick and steel flues by a 50,000-cu.ft. fan to a baghouse. Gases from the kettles and all other furnaces, with the exception of No. 3 softener, are conducted through brick flues to a rectangular brick stack 4x4 ft., and 100 ft. high.

Electric power for all operations is purchased from the Northern Indiana Public Service Company. Water is obtained from the city mains, which supply a 50,000-gal. tank elevated 50 ft. Water discharged from furnace jackets is returned to a 100,000-gal. sump tank and is pumped to the elevated tank. Steam is supplied from the plant of the Anaconda Lead

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Products Company. Fuel oil is received in standard tank cars on the high line track, and unloaded by gravity to storage tanks. Auxiliary equipment is housed in a brick and steel building west of the main refinery building. The building contains two electrically driven air compressors, a centrifugal compressor which furnishes air for oil burners, a 1,000-g.p.m. motor-driven water pump, and a steam-driven fuel oil pump.

Tooele bullion, cast in four-ton slabs, is received in gondola cars; East Helena bullion in 100-lb. bars in box cars. Tooele bullion is unloaded direct from cars by the overhead crane, which delivers the slabs to three 135-ton cast-iron, coal-fired, melting or drossing kettles. The molten bullion is pumped from the kettles by a centrifugal lead pump to the softeners as required.

Three 300-ton softening furnaces are used. They are rectangular reverberatory furnaces fired with coal. The hearth of each furnace consists of a steel box, water-jacketed on the sides and ends, lined with firebrick. The bullion is pumped into the furnace through working doors on either side. In the process of treatment the metal is alternately heated to 1,200 deg. F. and cooled to 900 deg., the resulting skim being removed at intervals of six to eight hours. A charge of 250 tons requires 48-hour softening. Softened lead is drawn off through tap holes to the desilverizing kettles. In addition to the furnace softening operations, approximately one-third of the bullion treated is softened in kettles with hydrated lime, a process developed at this plant in 1925.

Three 135-ton circular cast-iron, coal-fired kettles are used for desilverization. All kettles are served by a fifteen-ton overhead electric crane. Each kettle is provided with a Howard press attached to a jib crane operated by compressed air at 90-lb. pressure. Two additions of zinc are used in the desilverization. Zinc dross produced is delivered to dross storage bins adjacent to the retorts. Desilverized lead, which contains 0.55 per cent zinc, is pumped to the refining furnace.

The refining furnace is a 400-ton capacity coal-fired reverberatory similar in general design to the construction of the softeners. The charge is heated to 1,400 deg. F. Steam used for oxidation of the zinc is then introduced through 1¼-in. iron pipes inserted on each side of the furnace. The dross produced is skimmed from the metal bath until the zinc and traces of antimony and other impurities are removed. Then the metal is cooled to 950 deg. F., and discharged by gravity to the molding furnace, though a separate tap hole is provided to permit molding direct from the refining furnace. Both tap holes are fitted with 2½-in. extra-heavy iron plug cocks. The molding furnace, of 200 tons' capacity, is similar in design to the refining furnace, but not water-jacketed. A 5x5-ft. opening is provided in the roof of the furnace for charging scrap anodes and molding scrap. Adjacent to the furnace are 110 horizontal molds, arranged in an arc for the production of refined pig lead; also, 20 horizontal anode molds for the production of anodes for the Anaconda Lead Products Company. Pig lead and anodes are transferred from the molding circle to scales, weighed, and loaded into cars for shipment.

Six gas-fired Faber du Faur retorts are used for the recovery of zinc from the dross produced by the desilverizing kettles. Each graphite retort bottle is mounted in a separate tilting furnace. The retort is charged with 1,200 lb. of dross, a graphite condenser luted over the mouth of the retort, and the temperature is raised to 2,000 deg. F. As the zinc collects in the condenser, it is tapped out through a hole in the bottom and cast into slabs. When all zinc has been distilled, the condenser is removed, the retort tilted, and the retort bullion cast into bars for treatment in the cupels. Blue powder produced is recharged into the retorts. The zinc recovered is used in the desilvering kettles; and broken bottles and retort clay are charged to the blast furnaces.

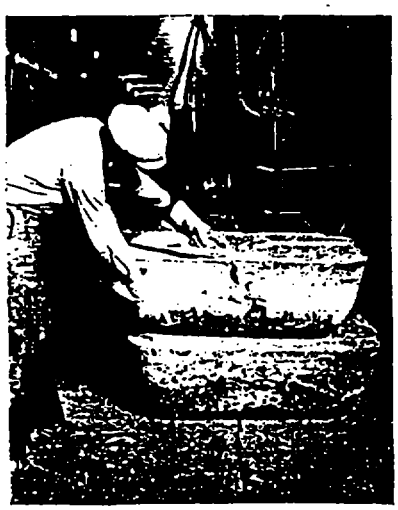
The three Rhodes type cupels are each of the same general size and construction. The "test" is lined with a mixture of crushed firebrick, fireclay, and portland cement. Each furnace is fired with fuel oil. Air for oxidation is introduced through 2-in. blow-pipes with slit nozzles, and retort bullion is charged through doors in the side walls. Litharge is skimmed off by tilting the hearth slightly. Alternate charging of retort bullion and skimming of litharge is continued until the cupel content approximates 90,000 oz. of silver, when the metal is then cleaned by addition of clean litharge and continued blowing with air to oxidize the impurities. The doré bullion, of 995 fineness, is cast into 1,100-oz. bars and shipped to the Raritan Copper Works in New Jersey for parting.

Residue furnace smelting is an intermediate step in the treatment of by-products to separate the antimony, silver, and copper from one another. The furnace is a coal-fired, reverberatory 8 ft. 6 in. x 36 ft. 9 in. x 2 ft. 8 in., similar in general construction to the softening furnaces. Materials charged consist principally of skims from the softening furnaces, litharge from the cupels, and copper dross produced by the removal of excess copper from residue or blast-furnace metal. The charge, including proper proportions of coal for reduction, and galena to form matte, is introduced into the furnace through two circular brick-lined openings in the roof. Products of the operation are a lead bullion containing most of the precious metals, a copper-lead matte, and a lead antimoniate slag low in silver. The lead bullion is pumped to the drossing kettles by a special centrifugal lead pump from a lead well near the firebox end of the furnace; the copper matte is shipped to Tooele, Utah; and the antimony slag is smelted in the blast furnace to produce antimonial lead.

The byproducts treated in the blast furnace consist principally of residue slag and refining furnace skim in the necessary proportions to produce a 15 per cent antimonial lead. The rest of the refining skim is smelted with broken retort bottles, retort clay, furnace brick, and cupel test breakings to product a base bullion. Baghouse dust is recharged.

Blast-furnace equipment consists of two circular, water-jacketed furnaces, 42 in. in diameter at the tuyères, and 14 ft. from tuyère line to charge floor. Each furnace has five 4-in. tuyères. Molten metal flows continuously from the lead well, whereas the slag is tapped at intervals and sent to the dump.

The antimonial metal is transferred to the drossing kettles, drossed with sulphur, and molded into bars for shipment. Base bullion is transferred to drossing kettles, mixed with residue metal, drossed with sulphur and finally refined.



Some one has attempted to steal these two blocks of lead in transit, as is evidenced by the marks on the side; the weight of four tons each proved discouraging

THE MINES HANDBOOK

SUCCEEDING

THE COPPER HANDBOOK

Founded by Horace J. Stevens, 1900

DESCRIBING

THE MINING COMPANIES OF THE TWO AMERICAN CONTINENTS

BY
WALTER GARFIELD NEALE

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partment, emergency hospital, office, etc. All buildings are of steel and concrete construction. About 1,200 men employed.

The smelting practice of copper ores largely follows Anaconda methods. The sulphide fines are roasted with a certain amount of siliceous ore added upon the fifth hearth of the roaster to heat the ore and keep the temperature at the right point. The ore is roasted down to 0.7% sulphur corresponding to a matte fall of 15 to 18 tons per day. The reverberatory slag, carrying 40 to 42% silica, is tapped at the back of the furnace and the matte, carrying 20 to 30% copper, conveyed in ladles to the converters. The converters, when operated only on day shift, are kept hot over night by filling them with cinders from the reverberatory furnaces. Silica is applied to the converter in lump ore, 2 boats to each 8-ton charge. The bag-house dust from the smelter fumes is removed by reversing the fan and direction of current, drawing the dust into the chamber beneath.

Direct connection with the mines at Bingham, is made through the Utah Metal & Tunnel Co.'s 11,500' tunnel, completed in 1913.

Production:

	Copper ore tons	Lead ore tons	Copper lb.	Lead lb.	Gold oz.	Silver oz.
1925†.....	78,762	234,046	20,669,490	112,105,154	33,842	8,479,090
1924.....	97,057	164,521	28,378,326	75,967,432	28,026	5,739,123
1923.....	100,765	196,550	31,056,440	63,538,501	28,524	6,327,395
1922 (6½ mos.)	40,193	77,663	10,879,094	20,271,233	11,579	2,685,836
1921*.....	.....	61,707	1,281,558	9,216,564	4,297	1,529,566
1920.....	104,210	200,788	9,901,906	46,136,951	22,580	4,180,890
1919.....	131,395	237,164	13,699,506	62,189,472	28,431	5,485,424
1918.....	262,723	297,847	21,821,657	62,034,920	36,317	5,827,135
1917.....	320,510	334,274	17,385,090	84,726,315	31,495	4,439,290
1916.....	442,756	421,197	20,041,089	117,976,091	40,009	5,549,777

* Copper plant not operating; lead plant for 6 mos. only.

† Concentrator treated 284,766 tons of ore from which there were produced 93,323 tons of concentrate, of which 40,697 tons were zinc concentrates which were shipped to electrolytic zinc plant at Great Falls.

RARITAN COPPER WORKS

Subsidiary of the Anaconda Copper Mng. Co.

Local address: W. G. Burns, mgr., Perth Amboy, N. J. F. R. Pyne, supt.; Edw. J. David, supt. elec. refineries.

The works on New York harbor, completed 1899, and since enlarged repeatedly, is one of the largest and most modern electrolytic copper refineries in the world. Expenditures planned in 1925 with installations in 1926 give plant capacity of 45,000,000 pounds of copper monthly. This will provide for handling production from the Andes Mines in Chile.

The smelting department consists of one 200 ton, one 150-ton and one 100-ton furnace for casting anodes, and two 225-ton, one 150-ton and two 100-ton furnaces for casting wire bars, ingots and cakes.

The electrolytic refinery includes 2 tank houses with their respective power houses; power consumption being about 7,000 k. w. The department has special shears for trimming cathode sheets and Morrow loop machines for attaching copper lugs to the cathode starting-sheets.

No. 2 tank house, 210x582', has 3 bays running lengthwise, with two 10-ton 3-motor Whiting cranes in each bay, equipped with special devices for handling an entire tankful of anodes or cathodes at 1 load. There are 3 electric circuits running lengthwise, 1 in each bay, each circuit of 396 tanks being handled from the power house by an electric generator. Current is 7,500 amperes, giving a current density of 20 amperes per sq. ft. The main conductor has a cross sectional area of 12¾". There are 1,188 depositing tanks arranged in 108 nests of 11 cells each, with electrode arrangement on the Walker system. Tank house No. 1 has 1,800 tanks; its general arrangement, and method of operation, is very similar to that in No. 2.

No. 1 power house, which furnishes power for No. 1 tank room, contains four 1,000 k. w. triple expansion Corliss engines and barometric condensers. The engines are direct-connected to four 1,000 k. w. electric generators. Beginning with 1920, fuel oil was substituted for coal throughout the plant; two 55,000 bbl. storage tanks were installed.

Production:

Year	Bullion Treated, copper, tons	Bullion Treated, silver, oz.	Copper lb.	Gold oz.	Silver oz.
1925*.....	.....	.....	405,803,075	128,591	20,578,003
1924.....	.....	.....	406,548,498	117,520	20,037,558
1923.....	.....	.....	398,294,865	98,914	20,643,095
1922.....	.....	.....	300,284,594	33,874	8,086,858
1921.....	.....	.....	169,700,240	51,474	10,370,834
1920.....	124,463	4,338,617	245,473,190	76,746	14,320,832
1919.....	165,443	6,514,988	326,671,962	120,629	19,503,574
1918.....	222,628	7,016,213	394,968,011	132,254	21,440,611
1917.....	209,557	5,806,924	411,933,742	137,465	19,938,375
1916.....	233,956	4,531,771	462,666,262	167,024	18,606,866

* Besides 28,335 lbs. selenium, 570 lbs. tellurium, 454,815 lbs. nickel sulphate, 1,054,000 copper sulphate, 253.92 oz. platinum and 748 oz. of palladium.

INTERNATIONAL LEAD REFINING CO.

Subsidiary of the Anaconda Copper Mng. Co.

Works address: G. E. Johnson, supt., East Chicago, Ind. New York address: 25 Broadway.

An extensive plant located at 151st St. and McCook Ave., East Chicago, Ind., on 64 acres of ground, erected in 1912. Plant comprises main refinery building, all steel and concrete, with 3 standard-gauge tracks entering the building. There are 2 crane runways running the full length of the building, with 3 traveling cranes. A change-house, of brick, is equipped with toilets, shower-baths, steel lockers, and a dining room. Bag-house is constructed of brick and concrete, divided into 4 compartments of 114 bags, 30'x18".

Equipment: consists of one 12,000-ton battery Parkes process, two 300-ton softeners, four 60-ton desilverizing kettles, one 300-ton refining furnace, and one 200-ton molding furnace. The bullion comes in on a high track, is charged into furnace with charging machine and flows by gravity through the plant. Lead is hand-molded and trucked into cars. Sampling is done in two 40-ton kettles and bullion pumped into softeners with centrifugal pump. Residues are worked up in three 30-ton reverberatory furnaces. There are two 40-ton blast furnaces, 1 for antimonial slag, and 1 for by-products and ores; 8 retort furnaces for treating zinc skim and two 5-ton cupels for treating high-grade retort metal.

Common lead is double refined by crystallization in kettles in the corroding lead plant. All furnace gases except from softeners and retorts are drawn through a sheet flue 700' long and passed through the bag house.

According to G. P. Hulst (Bull. 153 Sept., 1919, A. I. M. & M. E.) the works are able to treat both oxide and sulphide ores of antimony. All silver-bearing antimony ore is heated in the residue furnace, while antimony slag produced was low enough in silver to warrant being smelted in two 42" round blast furnaces to antimonial lead. When the domestic output of antimony ore increased in 1916, the International was ready to treat it.

Power is supplied by the Northern Indiana Gas & Electric Co. Two waste-heat boilers supply steam for compressors and refinery. High-pressure air is supplied by centrifugal air compressors and air for blast furnaces is supplied by a Connersville blower. Water is supplied by East Chicago Water Co. to 50,000 gal. tank, to which waste water also is pumped from a 100,000 gal. sump-tank. Oil storage capacity, two 12,000 gal. oil tanks.

Production:

Year	Lead bullion treated tons	*Other ore and bullion tons	Com. and cor'd'g lead lb.	Antimonial lead lb.	Gold oz.	Silver oz.
1925.....	67,137	.....	124,616,850	6,592,715	21,932	7,571,424
1924.....	57,479	.....	105,637,507	5,930,688	18,113	5,907,412
1923.....	52,096	.....	97,118,093	6,376,821	20,328	6,945,450
1922.....	12,843	.....	22,319,149	.....	3,750	1,486,553
1921.....	7,975	3,268	20,638,128	914,875	9,021	2,612,960
1920.....	23,457	4,267	49,173,237	2,811,008	11,897	3,438,371
1919.....	32,238	6,536	69,884,930	6,402,350	24,428	6,311,227
1918.....	31,766	34,119	113,074,263	13,018,043	36,361	7,004,176
1917.....	41,682	23,558	117,922,724	11,525,365	24,673	5,259,738
1916.....	58,769	6,148	108,009,116	15,682,151	20,580	4,468,775

* Included in first column after 1921.

Having experimented with a pilot plant, construction of a 20-retort French process plant at East Chicago with daily capacity of 16,000 lb. of zinc oxide per day, was begun and completed Jan. 1923. A similar plant was erected at Akron, Ohio, 2 units commencing production during 1923. In 1923 these two plants produced 12,887,242. In 1925 the two plants produced 44,797,773 pounds of merchantable zinc oxide of which 18,712,729 pounds were produced at East Chicago and 26,085,044 were produced at Akron. This compares with 41,884,095 pounds for both plants in 1924.

Anaconda Lead Products Co.: G. E. Johnson, supt., was formed in 1919 to manufacture electrolytic white lead. Its plant is at East Chicago, adjacent to that of International Lead Rfg. Co. In 1925 this plant produced 11,323,101 pounds of barrelled white lead which compared with 13,757,905 pounds in 1924.

Metal Roofing

The Copperclad Shingle Plant at Rutherford, N. J. produced 33,548 squares in 1925. Changes have been made so that operations are now on a satisfactory basis.

AMERICAN BRASS CO.

Early in 1922 the Anaconda Copper Mining Co. and its subsidiary, the United Metals Selling Co., acquired over 99% of the capital stock of American Brass (outstanding $15,000,000, par $100) by payment of $150 in cash and 3 shares of A. C. M. Co. stock for each share of the American Brass Co., which was incorporated in February, 1899, under the laws of Connecticut, and which was the result of a consolidation taking place in 1912 between the following companies: Ansonia Brass & Copper Co., Benedict & Burnham Mfg. Co., Coe Brass Mfg. Co., Waterbury Brass Co., Chicago Brass Co., Holmes, Booth & Haydens Co. In 1917 the Buffalo Copper & Brass Rolling Mills was acquired, and since the acquisition of American Brass by Anaconda there has been purchased the property of the Brown's Copper & Brass Rolling Mills, Ltd., at Toronto, Can., excepting the land and buildings, which were leased for a long period. Also the assets and property in 1923 of the National Conduit & Cable Co., Inc. situated at Hastings-on-Hudson, N. Y. (purchased by American Brass at receiver's sale for $3,000,000). This is now known as the Hastings-on-Hudson plant of American Brass. A new corporation known as Anaconda American Brass, Ltd., all of the stock of which is owned by American Brass Co., was formed to conduct the Canadian operations and to better serve the Canadian trade.

American Brass Co. has a plant at Torrington, Conn., one at Waterbury, Conn., one at Ansonia, Conn., one at Hastings-on-Hudson, one at Buffalo, N. Y., one at Kenosha, Wis., and the Anaconda-American Brass at West Toronto, Can.

These plants manufacture brass, copper and nickel-silver sheet wire, rod, tubes, etc.

Chas. F. Brooker is chairman of the board, John A. Coe, pres., E. L. Frisbie, v. p., E. H. Yates, sec., C. H. Hollister, treas., F. W. Judge and S. B. Terry, asst. treas. Directors: John A. Coe, Geo. H. Allen, E. L. Frisbie, C. H. Hollister, C. F. Kelley, John D. Ryan, B. B. Thayer, E. H. Yates.

In order that operations may be compared for the last seven years, the following table shows the output in pounds of manufactured product by the American Brass Co. before the merger with Anaconda, together with the latter's production at its big wire and rod mill in Montana.

Output of Manufactured Product

Year	American Brass	Great Falls	Total
1919.....	369,591,018	43,241,497	412,832,515
1920.....	405,178,719	74,596,787	479,775,506
1921.....	213,486,566	42,435,436	255,922,002
1922.....	412,571,729	68,403,742	480,975,471
1923.....	505,518,834	110,058,062	615,576,896
1924.....	519,749,665	107,931,230	627,680,895
1925.....	653,268,973	133,851,764	787,120,737

In contrast with the production of the American Brass Co. in 1925 of 653,268,973 pounds of fabricated material, it may be said that this compares with an average output by this company for the five years preceding the war of 266,000,000 pounds.

SILESIAN-AMERICAN CORP.

Silesian-American Corp. is controlled by a holding company in which a majority stock interest is owned by Anaconda Copper Mining Co. The stock of the holding company was to be placed in a 10-year voting trust.

The Silesian-American Corp. was organized July, 1926, to acquire from Geo. von Giesche's Heirs Mining Company, a German corporation, all of the capital stock of the Giesche Company, a Polish corporation, together with $6,000,000 of the German companies sinking fund mortgage bonds. The properties of the Giesche Company included crude zinc ore and coal reserves in large amounts.

The directors of the Silesian-American Corp. are John D. Ryan, W. Averell Harriman, C. F. Kelley, Geo. H. Walker and 3 members appointed by the Geo. von Giesche's Heirs Mining Co.

The capitalization of the Silesian-American Corp. consists of $12,000,000 of 7% non-cumulative preferred stock, $100 par value and 200,000 shares of no par value common stock; also $15,000,000 15-year 7% collateral trust sinking fund gold bonds brought out July 1926.

SOUTH AMERICAN COMPANIES

Andes Copper Mining Co., practically all the stock of which is owned by Anaconda, and Chile Copper Co., in which Anaconda owns a controlling stock interest, will be found described under their separate titles.

Santiago Mining Co. organized in 1917 with capitalization of $10,000,000, par $25, owns various properties which Anaconda has acquired and developed issuing stock in payment for cost of lands, equipment and development. Among the properties are the La Aguirre Mines, 500 acres, 12 miles from Santiago, Chile; Africana Mines and La Aguirre and Farfana farms. For two years past the Anaconda report has stated there was no change in this company's affairs.

Comment and analysis: Anaconda is the largest producing-fabricating copper mining enterprise in the world. It mines about 12½% of the world's copper, fabricates about 20%, refines approximately 22% and smelters roughly 18%.

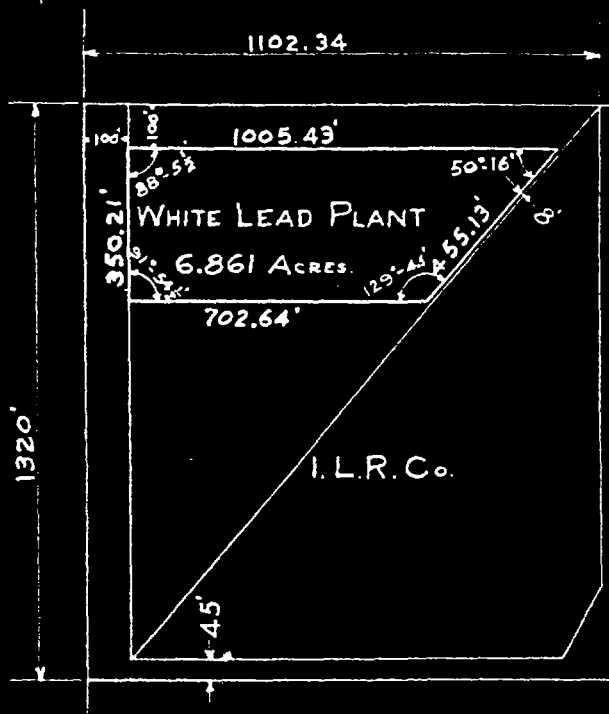
The mines at Butte are still the keystone of the whole Anaconda structure. In 1925 costs at these mines were reduced by a change in mining methods and ore reserves greatly augmented through making 34.19 miles of new mine openings.

COPY

Parcel of Property of the International Lead Refining Company, East Chicago, Indiana, to be leased to the Anaconda Lead Products Company.

Part of Block Four (4) in the subdivision of part of the Northwest Quarter of Section Thirty-three (33) Township Thirty-seven (37) North, Range Nine (9) West of the Second Principal Meridian, in Lake County, Indiana described as follows:

Beginning at a point which is the intersection of a line parallel to and one hundred (100) feet East of the West line of Section Thirty three (33) aforesaid, with a line parallel to and one hundred (100) feet South of the North line of Section Thirty-three (33) aforesaid; thence East on the last described line one thousand five and forty three hundredths (1005.43) feet; thence Southwesterly on a line which is at an angle of Fifty (50) Degrees and Sixteen (16) Minutes with the last described line four hundred fifty five and thirteen hundredths (455.13) feet; thence West on a line which is at an angle of one hundred twenty nine (129) Degrees and Forty four (44) Minutes with the last described line seven hundred two and sixty four hundredths (702.64) feet; thence North on a line which is at an angle of Ninety one (~~90~~) Degrees and Fifty four and one half (54 1/2) Minutes with the last described line three hundred fifty and twenty one hundredths (350.21) feet to the point of beginning, containing six and eight hundred sixty one thousandths (6.861) acres, more or less.



N.W. $\frac{1}{4}$, SECTION 33, TWP. 37 N. RANGE 9 W.

33

PROPERTY TO BE LEASED FOR WHITE LEAD PLANT

FROM INTERNATIONAL LEAD REFINING CO.

2-24-11 W-10

BRIEF DESCRIPTION OF ELECTROLYTIC WHITE LEAD PLANT OF THE ANACONDA LEAD PRODUCTS COMPANY

The plant was constructed in 1919 as the first commercial application of a new electrolytic process for the manufacture of White Lead developed on a laboratory scale by Elmer A. Sperry at Brooklyn, New York. Further development in a 1-ton pilot unit was carried on at East Chicago preceding the construction of the commercial unit. As originally constructed, the plant had an annual capacity of 3,600 tons. This has gradually been increased to 10,000 tons. The plant is located at 151st Street and McCook Avenue, East Chicago, Indiana, and occupies an area of six acres, forming part of the thirty-two acre area occupied jointly with the plants of the International Lead Refining Company and the Anaconda Zinc Oxide Department. The buildings shown in green on the attached map are the property of the Anaconda Lead Products Company.

Transportation Facilities

The Indiana Harbor Belt Railroad, the Baltimore and Ohio Chicago Terminal and the Pennsylvania Railroad enter the plant yard and furnish transportation facilities. In addition to the single track serving the White Lead Plant, four storage tracks having a capacity of 98 cars are provided for the three plants. The main track entering the storage yard passes over a 100 ton Fairbanks track scale. A narrow gauge track extends south from the cell room and connects with the narrow gauge system of the International Lead

Refining Company. Other transportation within the plant and Chicago area is handled by truck.

Buildings

The main cell room and filter building, the dryer building, sub-station and extension of the boiler house are of brick and steel construction. The pulverizer building is of steel and corrugated iron. The original boiler house, warehouse, carpenter shop and extensions to the cell room building are of wood and corrugated iron.

Cell Room

The White Lead is produced in 48 cells. No additional cells have been added, but increased capacity has been obtained by increased current density. The cells are constructed of concrete, lined with asphalt, with hard rubber fittings, and are connected in series by copper bus bars. Each cell contains 17 steel cathodes, each encased in a linen diaphragm, and 18 lead anodes. Three 3-ton electric monorail hoists deliver anodes from narrow gauge rack cars to the cells, and remove scrap. Lead anodes and scrap, loaded on rack cars, are transported by a gasoline locomotive over the narrow gauge system between the cell room and the plant of the International Lead Refining Company.

Solution System

The cathode and anode in the electrolytic cell are separated by the diaphragm surrounding the cathode. Separate electrolytes circulate about the cathode and anode and each electrolyte passes

through an independent circulating system. The catholyte discharged from the cell passes through a carbonating system which consists of a coke-burning boiler, gas lines, gas scrubber, and fan delivering the carbon dioxide gas to two vertical steel absorption towers with porcelain filling, through which the catholyte descends counter-currently to the flow of gas, and is returned to the cell. A reinforced concrete Dorr thickener, 25 ft. in diameter 10 ft. high, asphalt lined with lead covered steel mechanism, receives anolyte carrying the white lead in suspension from the cells. The clear anolyte over-flow from the thickener is returned to the cell.

Pumping Equipment and Sumps

Two cast iron centrifugal pumps deliver the cell catholyte discharge from concrete sumps to the carbonating towers, and two similar pumps deliver the carbonated catholyte to an overhead tank, from which it returns by gravity to the cathode frame. The flow of catholyte is handled in iron piping. Two bronze centrifugal pumps deliver the anolyte and suspended white lead from two concrete sumps to the Dorr thickener. The clear over-flow from the thickener flows to a concrete sump from which it is returned by two similar pumps to the cells. Rubber lined wooden launders, brass pipe and hard rubber pipe and rubber hose are used in the anolyte system. The cell room basement is water-proofed, and equipped with sumps and pumps for reclaiming solution drippage. The anode slime recovery system includes wash tanks, pumps and settling tanks.

Filter

A diaphragm pump transfers the thickened pulp from the Dorr thickener to a pulp storage tank from which it flows by gravity to the Moore filter. The Moore filter equipment consists of seven rectangular concrete tanks, two 4-ton mono-rail hoists, three filter baskets, two vacuum pumps, five filtrate pumps and receivers, and three wooden filtrate tanks. Rubber vacuum hose and brass pipe are necessary in the portion of the system handling anolyte; the remainder of the equipment, including receivers, is of iron. With this equipment the white lead is washed counter-currently, the enriched solutions returned to the main anolyte system and the washed white lead discharged to a small wooden storage bin. Intermediate storage of washed pulp between the filter and dryer is provided by a rectangular wooden pulp storage bin. The washed pulp is pumped from these storage bins to the dryer building.

Dryer

The drying equipment of the original plant consisted of one tunnel dryer 300 ft. in length, in which the white lead was dried on trays carried on rack cars. In 1921 the length of the tunnel was increased to 350 ft. and a second tunnel of equal length constructed. This equipment was replaced in 1927 and dismantled in 1928. At the present time, the washed white lead pulp, pumped from the storage bins, is delivered in the dryer building to a 4 ft. x 6 ft. Oliver filter for dewatering. The filter is equipped with a compression belt attachment. The filter cake is conveyed by belt conveyors to a swinging conveyor discharging the material across the

width of the dryer hearth. The dryer is a 12 ft. x 60 ft. Lowden Dryer with steam heated hearth plates of cast aluminum and bronze wire rabbles. A ventilating system, including a suction fan and hood covering the hearth area of the dryer, is used to remove water vapor. The material is dried as it is conveyed over the hearth surface by the rabble mechanism. It is discharged from the Lowden Dryer for additional drying upon a steam heated drag conveyor 84 ft. in length, the discharge of which is elevated to a storage bin in the pulverizer building.

Pulverizer

The white lead from the storage bin is pulverized in a Raymond Roller Mill with air separation system, which delivers the air-floated and dried product from a cyclone collector through a packer into wooden barrels for shipment. The air supply to the air circulation system of the Raymond Mill is heated by a McCann-Harrison heater, and the excess air is withdrawn through a Dracco filter. The pulverizer building is equipped with a Fairbanks platform scale and a Toledo platform scale for weighing the barrelled product. A set of rolls is installed for the production of special products. The barrelled product is delivered directly into cars from a loading platform extending the length of the building.

Warehouse

A frame and corrugated iron warehouse, having a floor area of 2,500 sq. ft., adjacent to the pulverizer building and served by the same track, is used for current stock of barrelled product and for empty barrels.

Sub-Station

All power used by the three plants occupying the area is purchased from the Northern Indiana Public Service Company, and enters the Anaconda Lead Products Company Sub-station at 11,000 volts. All incoming power is transformed from 11,000 volts to 2,200 volts before distribution. A portion is further transformed for equipment requiring lower voltages. The sub-station contains switchboard equipment for general distribution of power, a 3,600 ampere, 240 volt motor generator set controlled by automatic switchboard equipment, for supplying direct current to the cell room, and a 25 K.W. 250 volt motor generator set for furnishing direct current for hoists. The automatic switchboard equipment was installed in 1929. Air for cooling generators and transformers is drawn from the outside through a spray washer and cooler.

Boiler House

The steam boiler equipment of the original plant consisted of two 60 H.P. and one 35 H.P. locomotive-type boilers. A 150 H.P. boiler of similar type was added in 1921. A 225 H.P. Stirling boiler, equipped with automatic stoker, was installed in 1926 replacing the locomotive type boiler equipment, with the exception of the 35 H.P. boiler. The locomotive type equipment is still intact and is available for use when necessary. The boiler plant is equipped with feed water heater, pumps and auxiliary equipment. Coal for the Stirling boiler is delivered to an overhead bin by a belt elevator. This boiler plant furnishes steam for drying white lead, heating buildings, and other general purposes as required by the three plants.

The 35 H.P. locomotive-type boiler is fired with coke, and used as a carbon dioxide gas producer for the carbonating system. A Permutit water softener, which furnishes water for the boilers in the three plants, is installed in a small building adjacent to the boiler plant. This building also contains a 250 g.p.m. Gould Triplex pump, formerly used for delivering water from the city supply to an elevated wooden storage tank. Increase in city water pressure has made this equipment unnecessary. Metered city water is used on the Moore filter and for all other purposes.

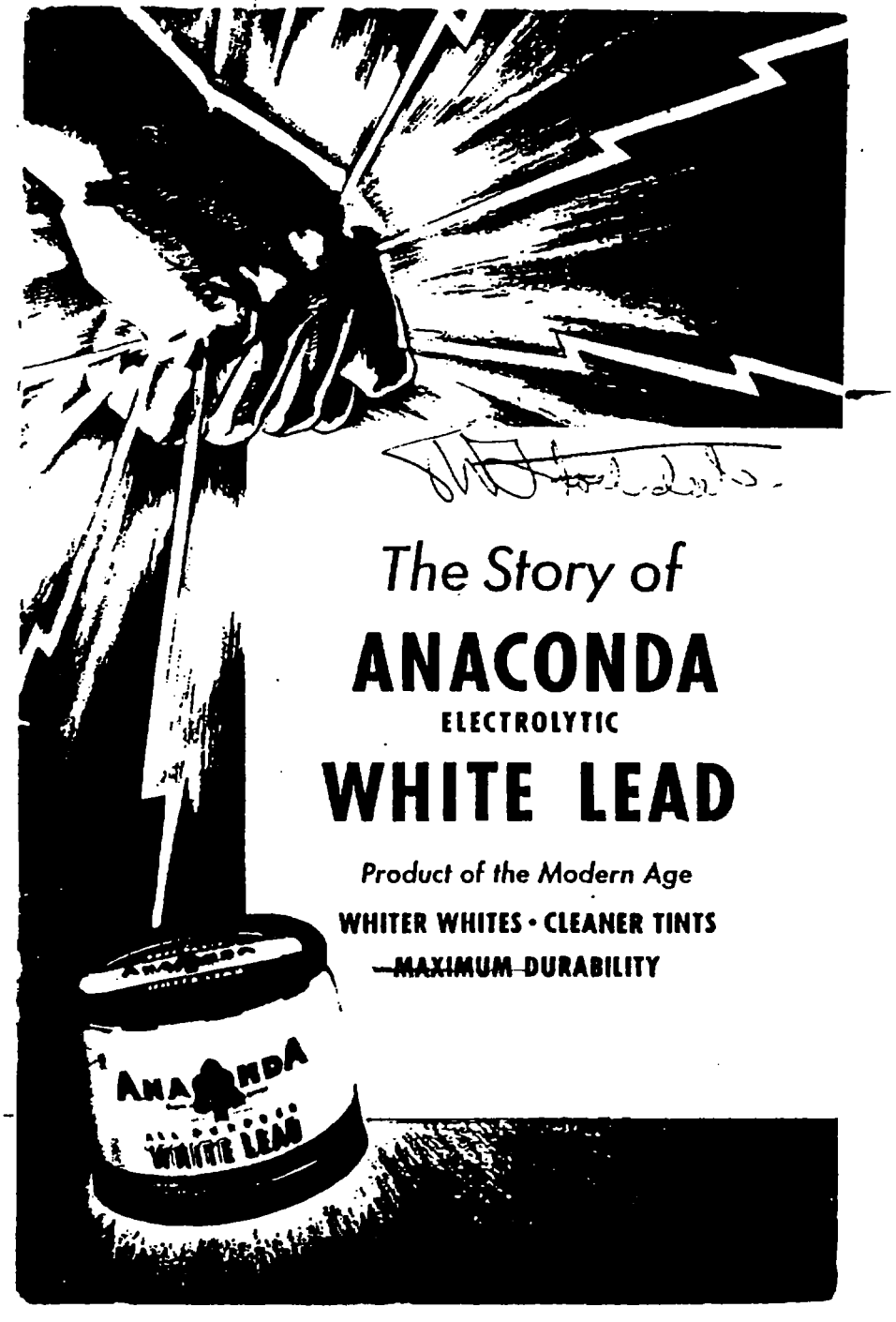
Change House

A 20 ft. x 40 ft. frame building, equipped with steel lockers, shower baths and toilet facilities, is used for a change house.

Shops

A 30 ft. x 40 ft. frame and corrugated iron building, originally used as a general shop, is now used as a carpenter shop for the three plants. The equipment consists of a planer, table saw and band saw. A small frame and corrugated iron building adjacent to the cell room, is used as a shop for repair of cathode frames. This building formerly housed the anode straightening press prior to the transfer of this operation to the Refinery. The general office building, storeroom and shops, analytical and research laboratories and other general service departments including fire protection, owned by the International Lead Refining Company, are used by the Anaconda Lead Products Company.

ANACONDA LEAD
PRODUCTS COMPANY
- - - -
Buildings
Indicated
In Green
N



The Story of

ANACONDA

ELECTROLYTIC

WHITE LEAD

Product of the Modern Age

WHITER WHITES • CLEANER TINTS

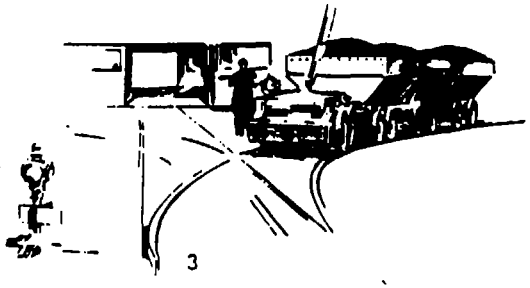
—MAXIMUM DURABILITY

Typical scene of the rugged Utah country where complex lead-zinc ores are mined— the beginning of Anaconda White Lead.

Head frame at mine shaft.

THE METAL used in making Anaconda White Lead originates in the vast complex lead-zinc ore bodies found in the state of Utah. Mined and smelted in the West, lead bullion is then shipped to East Chicago, Indiana, where it is refined and used in the production of Anaconda White Lead. A brief, illustrated "*from mine to finished product*" story is presented on the following pages.

As mined, the ore contains lead, zinc, arsenic, antimony, silver, gold, and copper. This ore is shipped to Anaconda's subsidiary, International Smelting and Refining Company at Tooele, Utah, thirty-five miles southwest of Salt Lake City.



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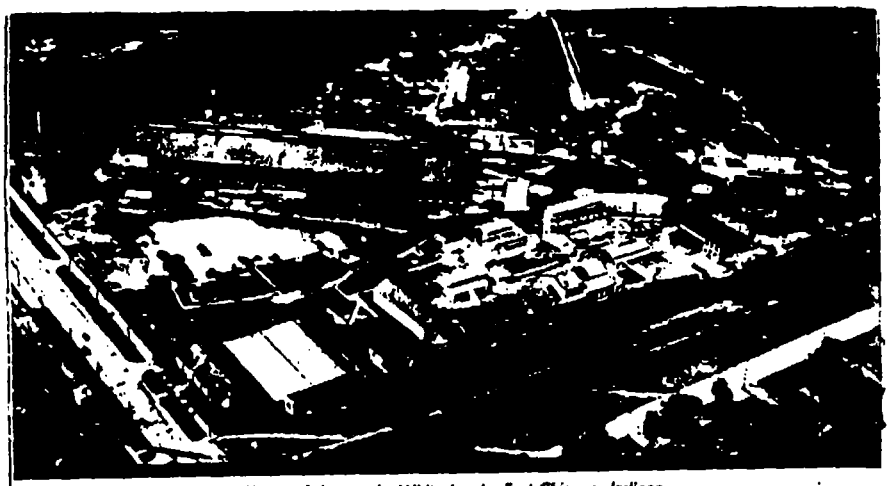


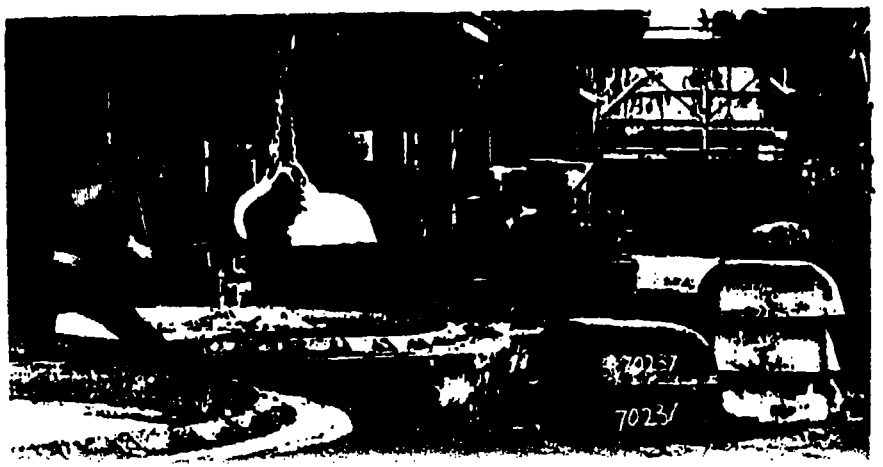
Home of Anaconda White Lead—East Chicago, Indiana

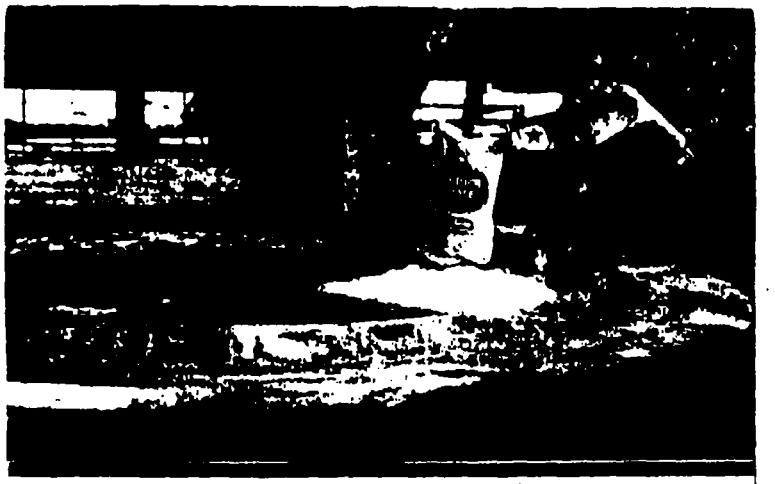
These pigs or blocks of bullion are removed from the moulds and shipped by rail to East Chicago, Indiana, for refining.

THE ANACONDA PLANT at East Chicago, Indiana, 20 miles southeast of Chicago, receives the four-ton blocks of bullion from the West. Here the various metals present in the bullion are separated by the Parkes' process. A good quality of common lead is finally obtained, and from this Anaconda White Lead is made.

First, the four-ton blocks are removed from the car by heavy tongs into a kettle for melting down. Thus the refining begins.

Refining starts with melting down the four-ton pigs.





Slaked lime is added to the molten metal.

To the surface of the molten bullion, lime is added—common slaked lime, such as the builder uses. The temperature is raised, and by agitation and the introduction of high pressure air beneath the surface of the bullion, the metal is "softened".

The lime then combines with the arsenic and antimony present, forming a dross which floats to the surface and is readily skimmed away. These by-product metals are, of course, sal-

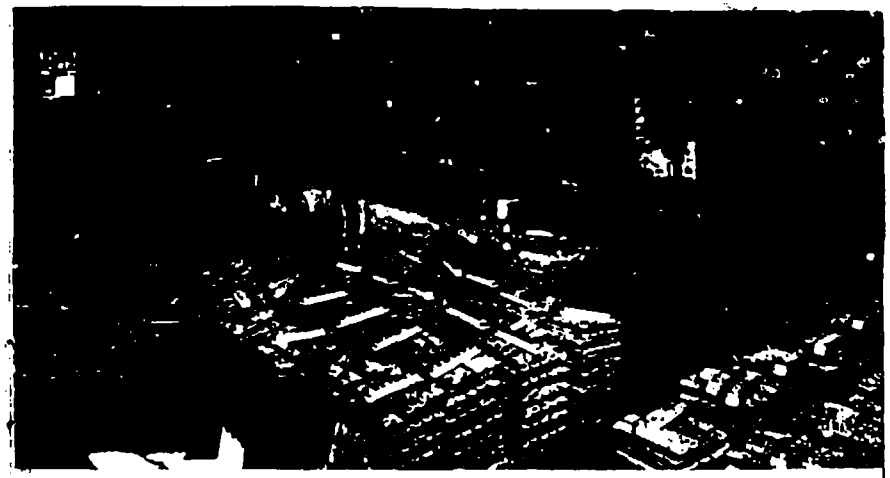
Arsenic and antimony combine with the lime and are skimmed off.

Molten metal is pumped to the desilverizing kettles where zinc is added.

vaged as was the copper, previously removed. The metal in its molten state can be pumped like water and is so transferred to the desilverizing kettles where the gold and silver are removed. This is accomplished by the addition of zinc which again forms a dross. This dross floats to the top and is skimmed away by hand and treated by another process to recover the precious metals.

The lead, with the exception of the zinc content, is now com-

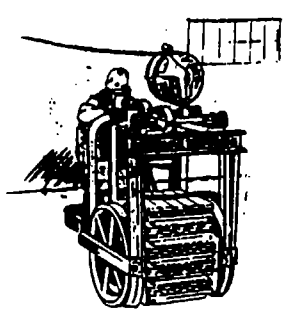
Dross carrying silver and gold is removed by skimming.



Refining furnace where zinc is removed from the lead.

mercially pure. The zinc is oxidized off in a reverberatory furnace leaving commercially pure common lead from which Anaconda White Lead is made. This lead is also cast into pigs or bars weighing 100 pounds and sold to make sheet lead, plumbers' supplies, cable sheathing, solders, and many other items of general use.

THE LEAD used to make Anaconda White Lead is transferred to a special moulding kettle and there, under the most careful



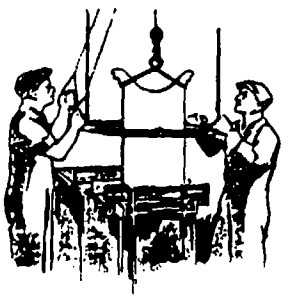
One form of commercial lead—100-pound pigs or bars on special trucks.

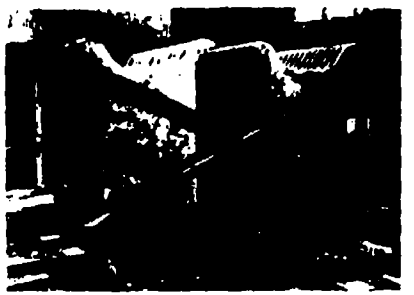
Casting lead anodes for use in making Anaconda White Lead.

control, is cast into sheets or anodes about an inch in thickness, some 20 inches wide, and 30 inches high. Such an anode weighs approximately 250 pounds.

These are straightened and placed in a specially designed car so spaced that they may be removed eighteen at a time and placed in electrolytic cells when the car is delivered to the white lead plant.

A BETTER WHITE LEAD is produced today because of a genius who knew no bounds, Elmer A. Sperry. At the age of





Specially designed car with load of lead anodes.

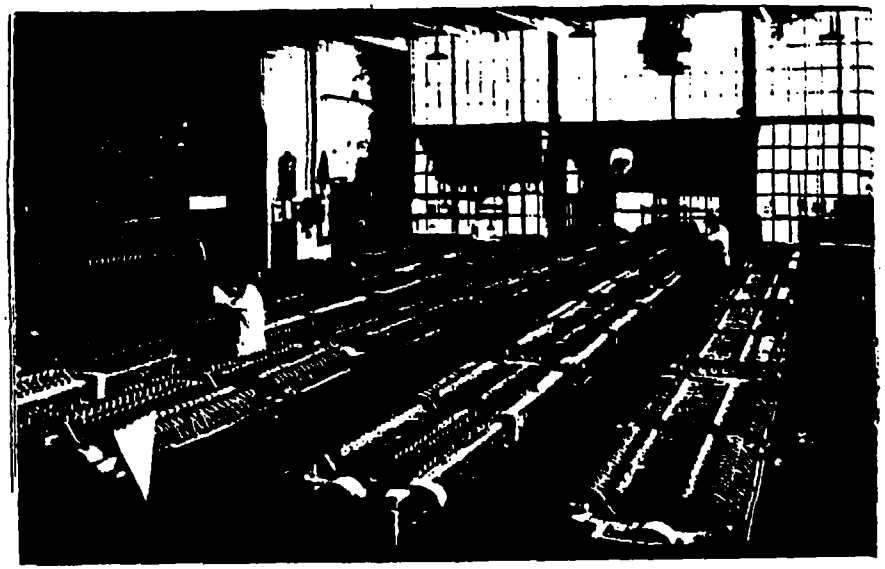
Elmer A. Sperry. Inventor of the electro-chemical method of white lead production.

14 he worked out twelve original solutions of the Pythagorean Proposition, known to all schoolboys as "The Dunce's Stumbling Block".

MACHINERY, moving parts, electricity—these things fascinated Sperry as a boy. His energy was tireless. He built everything from home-made windmills and glass-blowing outfits to fast-moving railroad hand cars. At the age of 19 his career began in earnest—first with dynamos and arc lamps, then electric locomotives and automobiles, better batteries, mining machinery—the list of his accomplishments is too long to enumerate.

During the World War his work for the U. S. Government was invaluable. Soon after, one of Sperry's many successful experiments in the field of electro-chemistry led to a revolutionary new process—the electrolytic production of extremely pure white lead from common lead. This patented Sperry process is used today *exclusively* for making Anaconda White Lead.

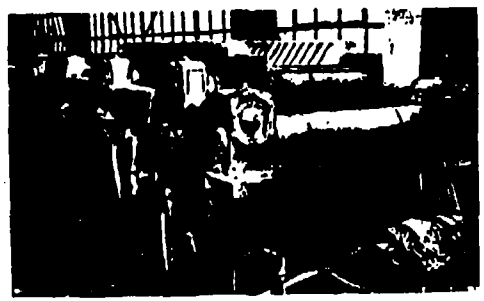
THE SPERRY PROCESS for making white lead is somewhat the same in action as the platers' cell. Lead is removed from an



View of electrolytic cell room.

anode into solution, but instead of plating out, it is acted upon by other chemical elements to form white lead in the solution of the cell.

The technical description on pages 16 and 17 explains how lead, acted upon by electricity and chemicals, is turned into lead carbonate or white lead. The white lead formed in this manner is exceptionally pure. This reaction takes place in a concrete cell, and as the white lead is made it is washed out of the cell by circulating solutions.



Wash machine for removing impurities remaining on the surface of anodes.

Circulating solutions remove the white lead as it is produced in the cell.

Each cell produces about one thousand pounds of white lead a day. The anodes, or sheets of lead, dissolve into solution and are replaced every two days.

Commercially pure common lead still contains traces of the metals that have been removed. These impurities, even in the minute quantities present, are eliminated from white lead produced by the Sperry process. Careful laboratory control maintains a high-grade product of unvarying uniformity.

The Sperry Electrolytic White Lead Process

A TECHNICAL DESCRIPTION

THE Sperry electrolytic cell as operated to produce white lead consists of a concrete cell in which are suspended lead anodes and insoluble iron cathodes. The cathodes are encased in porous fabric envelopes which act as diaphragms, separating the electrodes. Through the compartment formed by the fabric envelope surrounding the cathode is circulated the catholyte. This electrolyte contains sodium acetate and a large amount of sodium carbonate. The cell tank is filled with the anolyte which circulates around the submerged anodes and the outer surface of the diaphragm.

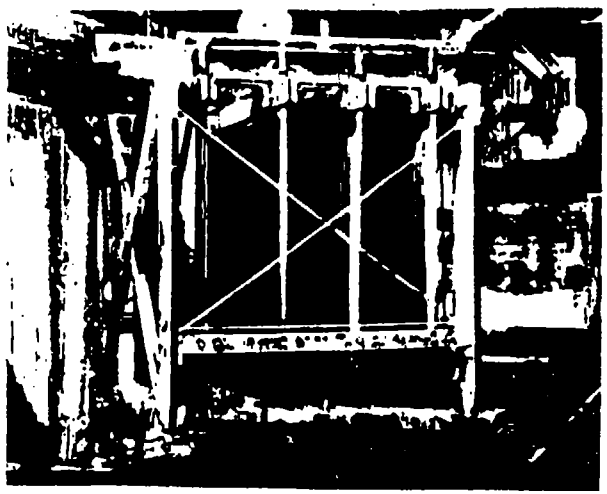
The anolyte contains sodium acetate and only a trace of sodium carbonate. Each electrolyte is maintained in rapid circulation about its electrode. The circulation systems of the two electrolytes are entirely independent, and no communication exists between the catholyte and anolyte save through the diaphragm of the cell.

The cell is placed in operation by passing direct current through the cell. Carbonate and hydroxide ions migrate under the influence of the current from the catholyte through the diaphragm to the anolyte; at the same time electrochemical equivalent amounts of lead ions dissolve from the surface of the lead anodes and pass momentarily into solution in the anolyte. Since the anions are more mobile than the cations the plane in which the ions meet is quite close to the surface of the anode. In this plane precipitation takes place, and white lead is formed. Due to a slight seepage of catholyte through the diaphragm the anions are transferred to the anolyte in amounts in excess of the reaction requirements. This results in complete precipitation of the lead ions dissolved from the anode.

The continuous flow of anolyte removes the white lead from the cell as fast as it is formed. From the cell the anolyte flows to a settler where the white lead is removed and the clean overflow from the settlers is returned continuously to the cell. The catholyte in its circulation external to the cell is carbonated to replenish the carbonate ions and neutralize excessive hydroxide ions formed at surface of the cathode.

The settled white lead is removed continuously from the bottom of the settler to a filter where it passes through a countercurrent washing cycle to remove and recover the anolyte solution. The washed white lead pulp is dried, ground and air floated, and is then barrelled in a dry pulverent form.

A study of the cell reactions indicates that the formula for white lead should be written $Pb(CO_3PbOH)_2$ and that this compound is formed through the reactions of the intermediate compounds $Pb(CO_3H)_2$ and $Pb(OH)_2$. The outstanding characteristics of electrolytic white lead—exceptional purity, brilliant whiteness and uniformity—are due to the ease with which cell reactions can be controlled and to the fact that in the cell only the lead is dissolved from the surface of the lead anode, other metals remaining on the anode surface in the form of a slime.



Remaining chemicals are washed out on a suction filter.

The removal of impurities by the Sperry process described, explains why only Anaconda offers the trade a white lead pigment, pure white in color. Such a white pigment, when mixed with colors gives true tones of the basic color; hence, brilliant colors that please.

The white lead is settled out and washed on a suction filter. The wash solutions are pulled through the mass of white lead which adheres to the filter leaves.

This vacuum washing completely removes the chemicals used in making the white lead and leaves what is called a washed pulp.

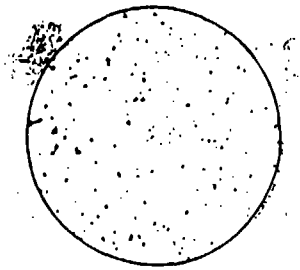


Photo-micrograph of Anaconda White Lead showing extreme uniformity of particles.

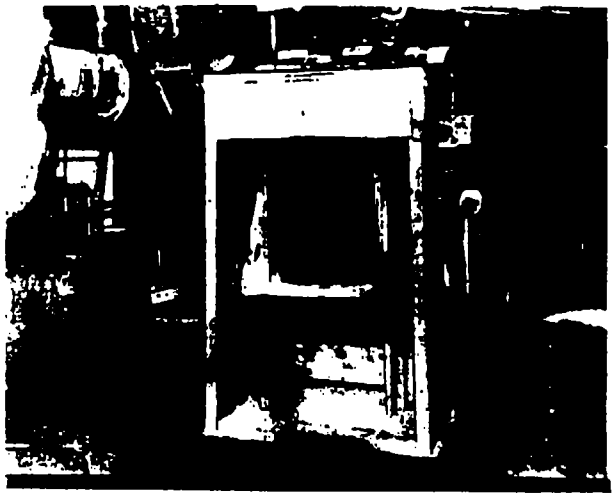
Loaded suction filter.

This rotary filter completes the washing and removes most of the water.

Being precipitated chemically, the white lead is extremely fine. Anaconda White Lead is so fine that 99% will pass through a 325 mesh screen, leaving less than 1% on the surface. A rotary filter completes the washing and removes all but 30% of the water. The filter cake is now in the form of a very sticky mass much like a heavy wet clay.

To maintain its whiteness and protect it from contamination by dirt in the air, it is dried beneath a hood on a metal hearth plate heated by steam.

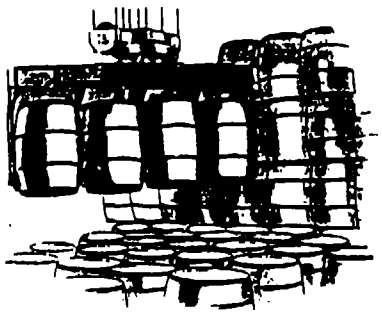
To maintain purity and whiteness, the white lead is dried on covered, heated hearth plates. Left: Discharge end. Right: Feed end.



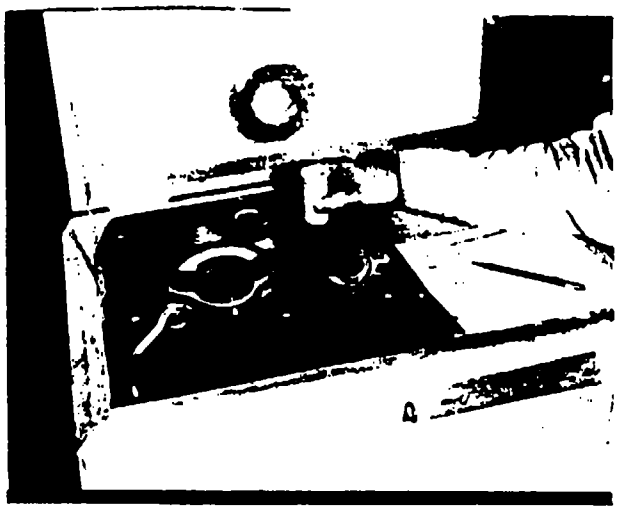
Ground to a fine powder, the white lead is immediately barrelled.

The mass is moved along, broken up and stirred by a rabble mechanism that finally discharges it dry after an hour or so of treatment.

In order to break up the lumps that form in drying, the product is put through a grinding process that crushes it to a fine powder and lifts the dust formed in an air stream some 18 feet high, thus insuring a product both uniform and very fine.



Barrels are placed in storage four at a time.



Testing the dryness of Anaconda White Lead.

ANACONDA WHITE LEAD is dried to three-tenths of one percent, practically all moisture having been eliminated before grinding. The product is then barrelled.

This is the dry white lead of commerce used in the manufacture of high-grade mixed paints and also ground into Anaconda Lead-in-Oil.

Unretouched photo of the relative whiteness of Anaconda White Lead and new-fallen snow.

Dry white lead is being mixed with pure linseed oil—

Anaconda Lead-In-Oil

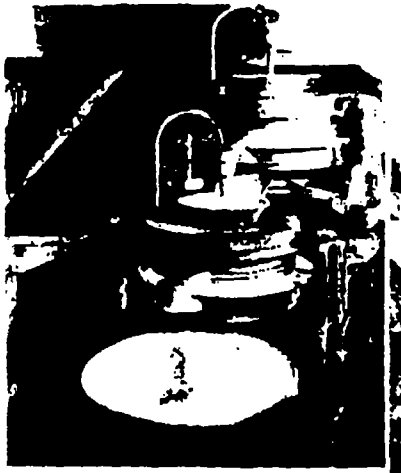
Dry white lead is mixed with pure linseed oil of the very finest quality and double ground between stone wheels to insure the incorporation of all of the white lead in the oil. Because of the heat generated, the mills are water cooled.

The ground lead-in-oil is then placed in Anaconda's modern containers, weighed and sealed.

Anaconda Lead-In-Oil is easy to mix. No hours of stirring are necessary to mix settled pigments.

The particles in different white leads vary considerably in size and shape. The particles in Anaconda White Lead are properly balanced in size and number to permit perfect incorporation in linseed oil, assuring smooth brushing and good levelling. Fineness makes for better covering and hiding, producing an all-round paint of highest quality.

Due to the absence of impurities, Anaconda produces whiter whites. Anaconda White Lead will actually make a white spot on ordinary white lead.



— and double ground between stone wheels (above).

Right: Sealing the familiar Anaconda White Lead containers.

Its true white color permits cleaner tints that are strikingly brilliant. The pure white base, to which the tint is added, does not have the slightly muddy cast that is present in ordinary lead. Anaconda Lead-In-Oil weathers by a slow chalking process. It produces a film that will last for years and one that washes itself clean as it ages.

Inside or out, Anaconda White Lead surpasses as a decorative medium, yet costs no more.

Employ a good painter. He knows the different woods and how to treat the surface before applying paint. Then insist that he use Anaconda White Lead-In-Oil.

Anaconda White Lead-In-Oil is sold by leading paint and hardware stores and lumber yards. When you select paint, be sure to specify Anaconda.

INTERNATIONAL SMELTING AND REFINING COMPANY

PIGMENT DIVISION . . . EAST CHICAGO, IND.

Subsidiary of Anaconda Copper Mining Company

Pioneer Work in Development of White-Lead Manufacture by Sperry Electrolytic Process

By R. G. BOWMAN

Assistant Superintendent, Anaconda Lead Products Company

TWENTY PER CENT of the lead consumed in the United States is used in the manufacture of pigments. Of this amount, 80 per cent, or 125,000 tons of lead per year, goes into the production of white lead. The first application of this, the best white pigment known, is lost in antiquity. Ancient methods have characterized its manufacture to the present time, and their quaint clumsiness has been credited with imparting to the product a homespun quality of purity and integrity that could not be secured in any other manner.

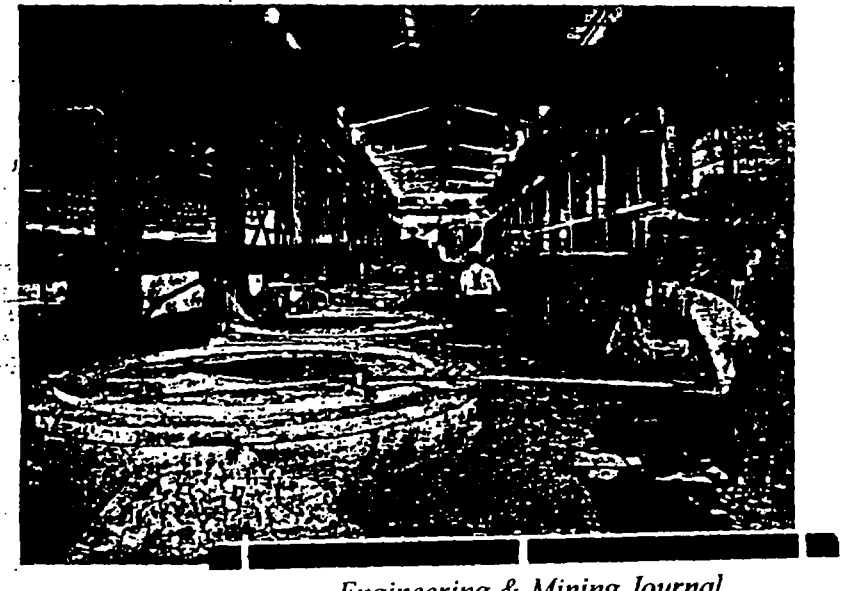
The Sperry process for the production of white lead by electrolysis represents perhaps the most striking advance in this industry in recent years. In this process, a bi-fluid cell is employed having a lead anode and an iron cathode, separated by a linen diaphragm. Electrolytes used are sodium acetate solutions containing sodium carbonate. The anolyte contains the exact amount of carbonate necessary to precipitate the lead compound desired; the catholyte contains a relatively large amount of carbonate and acts as a feeder to maintain the exact concentration of the anolyte. The lead dissolves at the anode surface and is immediately reprecipitated as basic carbonate in suspension in the anolyte. A corresponding transfer of CO_3 through the diaphragm from the catholyte maintains the concentration of the anolyte unchanged, and the process continues, producing a compound of uniform composition.

Electrolytes are maintained in rapid circulation through the cell. The catholyte in passing through the cell transfers the required amount of CO_3 to the anolyte and leaves the cell to pass through a carbon dioxide absorption tower, where it is restored to its original composition. The anolyte circulates without change in composition. White lead leaves the cell continuously in suspension in the anolyte, from which it is removed by settling and filtration, the clear anolyte returning to the cell. The settled white lead is washed, dried, and barreled.

Common desilverized lead is used for the anode; the purity of the white lead produced is independent of the purity of the lead anode, for the reason that the lead alone dissolves, the other metals present in the anode remaining as a closely adherent slime on the anode surface. This is scoured from the anode at short intervals, collected, and treated for the recovery of its metal contents.

THE white-lead plant of the Anaconda Lead Products Company at East Chicago, Ind., was built in 1919; it has a capacity of 28 tons of dry white lead per 24 hours.

Kettle floor of the East Chicago lead refinery



Electric power is purchased at 11 volts and transformed to the volt required for power purposes. A mo generator set supplies the direct rent for electrolysis. The substa is designed for completely autom operation.

The cell room contains 49 cells 18 anodes each, with the electrodes nected in parallel and the cells series. Cell voltage is approxima 3 volts. A rectangular concrete with hopper bottom leading to an verted siphon discharge forms containing vessel. The anodes ractangular lead plates 21x30½ in 1 in. thick, and weigh 250 lb. These are cast with projecting lug the upper corners and are suspe in the cell with one lug resting knife-edge busbar. Steel sheets, in. thick, form the cathodes, each which is inclosed in an envelope heavy linen duck supported by a fr of hard rubber.

Catholyte is supplied to each cath frame by a separate feed tube, cir lates about the cathode, and overflo through a spout at the top. The sp catholyte is pumped through a carb ating tower and returns to the cell.

Anolyte enters the cell through merged feed pipes, circulates about anodes, and passes out through bottom of the cell, carrying the wh lead in suspension. The combined charge of all cells, carrying abo ½ per cent white lead in suspension pumped to a 25-ft. Dorr thickener the clear overflow returned to the cel Thickened pulp, containing 30 per white lead, is filtered on a Moore filt Displacement of solution is effected a series of counter-current washes, solution being returned to the anoly system. The cake is washed in fresh water until free of soluble sa and discharged. The pulp of wh lead and water is pumped to an Oliv filter, which reduces the moisture 35 per cent before delivery to a Lowde drier having a steam-jacketed hear 12 ft. wide and 60 ft. long, of cas aluminum.

After drying, the white lead is final pulverized in a Raymond mill, deliv ered to a packing machine, and bar reled for market. Its particle size determined in the original precipitatio in the cell, the function of the pulve izing operation being merely to brea up small lumps and aggregates pro duced in drying. The mill is equipp with a heated air supply to insur complete removal of the last trac of moisture from the product befor shipment.

The white lead produced by the ele trolytic process is a true basic carbo nate. It is exceptionally pure, uniform in composition and physical properties and brilliantly white. It is a superio pigment for all purposes, and finds spe cial application where exceptional white ness or purity of color is demanded. In its development, Anaconda has written an important chapter in the history of the oldest chemical pigment known to man.

Brief Description of the Plants of the
ANACONDA ZINC OXIDE DEPARTMENT
International Lead Refining Company

The Anaconda Zinc Oxide Department has two plants: One located at East Chicago, Indiana, and the other at Akron, Ohio. The East Chicago Plant is about twenty-seven miles from the heart of Chicago and is located in the industrial district of Lake County, Indiana, The Akron Plant is located in Summit County, Ohio, thirty-five miles South of Cleveland, and is singularly well situated to serve the heart of the rubber industry.

This department started it's activities with a pilot unit at East Chicago in the Summer of 1921. In 1922 the first commercial unit was started at East Chicago. In January, 1923, a duplicate commercial unit was started at Akron. The second and larger units of both plants were constructed in 1923 and started operations in January, 1924. The American furnace units were constructed in 1925. Since then changes have been made as required, but no large units have been added.

THE EAST CHICAGO PLANT

The East Chicago Plant consists of two French Zinc Oxide furnaces; one American Zinc Oxide furnace, and one experimental unit. These units have adjacent to them a packing house, two warehouses, a machine shop, and laboratories. (See attached maps). The plant is served by the Indiana Harbor Belt, New York Central, Baltimore and Ohio Chicago Terminal and Pennsylvania Railroads.

French Oxide Units:

The French Oxide furnaces have a combined capacity of fifty-five tons per day of finished zinc oxide. One furnace produces approximately twenty-five tons per day, and the other thirty when under full charge. The furnaces are oil fired and are equipped with waste heat boilers. These boilers furnish the steam necessary to heat the fuel oil, change house, laboratories and other buildings. The French furnaces, together with their flues, fans, settling chambers, and baghouses, are so arranged that the units are entirely flexible. They may be used to produce any grade of French Oxide from the lowest grade lead free oxide to the seal zinc oxides, and the highest quality of U. S. Pharmaceutical Zinc Oxide. In producing these zinc oxides, Anaconda Electrolytic Zinc is used, the purity of metal used depending upon the oxides required.

American Process Zinc Oxide Unit:

The East Chicago American Block has a capacity of about five tons per day of finished oxide. This unit consists of the usual Wetherill grate furnaces with the necessary flues, fan and baghouse. This furnace may use scrap zinc materials containing lead, where leaded zincs are produced; or roasted dross or other materials from the Anaconda plants from the West, where lead free is required.

All of the oxides produced at East Chicago be packed in one building, three separate packing units being provided. A packing unit consists of the usual bins, mixing equipment, elevators, screening equipment and packer. The packer may be used to pack either bags or barrels. The capacity of the packers is about 75 tons per day. This is somewhat in excess of production and this enables the plant to rework and repack materials not up to standard.

After packing the oxides are either loaded into cars from the platform where six cars may be spotted at a time, or they are stored in one of two warehouses. These Warehouses have a combined capacity of 2,500 tons of oxide.

Auxiliary Equipment:

A Raymond Mill with air-separating equipment attached is setup at East Chicago and has a capacity of between eight and twelve tons per day (depends upon separation required). This is used for the recovery of various off-grade products where it is necessary to separate or air-float the zinc oxide from heavier impurities.

Miscellaneous Buildings and Equipment:

Oil storage and handling equipment is available with a capacity of 40,000 gallons of fuel oil. Fuel oil tanks are enclosed in a concrete dyke to minimize fire hazard or damage due to tank breakage. The latest type of foamite and steam fire fighting equipment is available, being piped separately to each tank.

A substation, refractory storage building, combustable warehouse, and zinc unloading equipment are among the minor items of equipment.

Machine Shop:

The Zinc Oxide Department has access to two Machine Shops; one small one in the plant itself, and a large one in connection with the Lead Refinery at East Chicago. Service work and minor repairs are handled in the shop adjacent to the zinc oxide units. It is only necessary to use the large shop for very heavy work, lathe work and major electrical repair work.

Laboratories:

Samples from current production are tested in two routine laboratories. One of these handles the color, brightness and oil absorption grading, and the other handles other physical and chemical tests.

In addition to the usual routine testing, the East Chicago plant has a large research and development laboratory. Therein we are equipped to study practically every phase of the commercial use of zinc oxide and white lead pigments. The three main uses for our pigments are concerned with the paint, rubber and ceramic industries. The

spur track off the main line (East and West) of the Baltimore and Ohio Railroad.

Auxiliary Buildings and Equipment:

The auxiliary equipment consists of a machine shop, substation, repair shop, oil storage and handling facilities, steam boilers, refractory storage building, combustable warehouses and plant offices. Physical and chemical laboratories are also provided.

The Main Office at Akron not only serves to handle the operating details but also as a District Sales Office.

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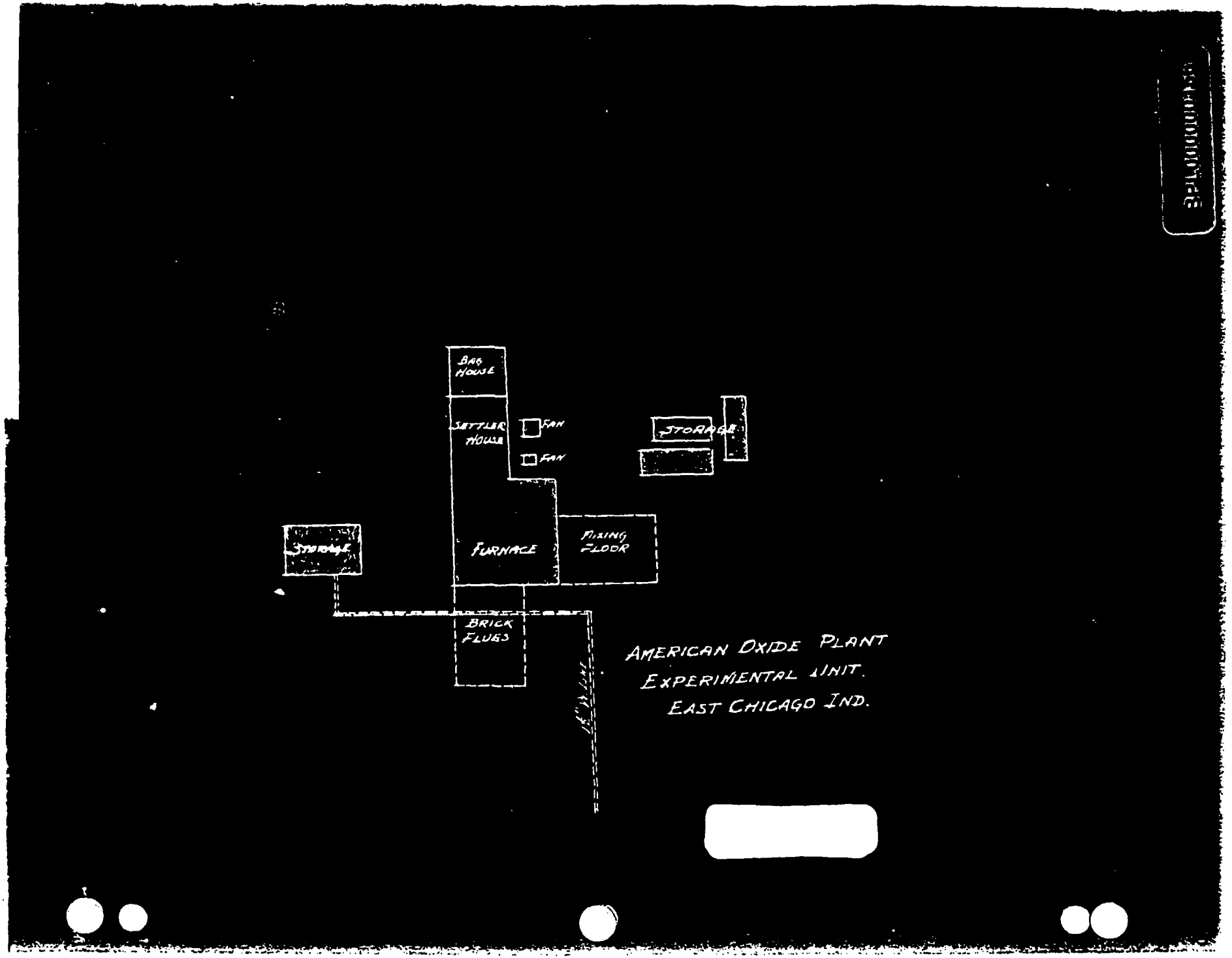
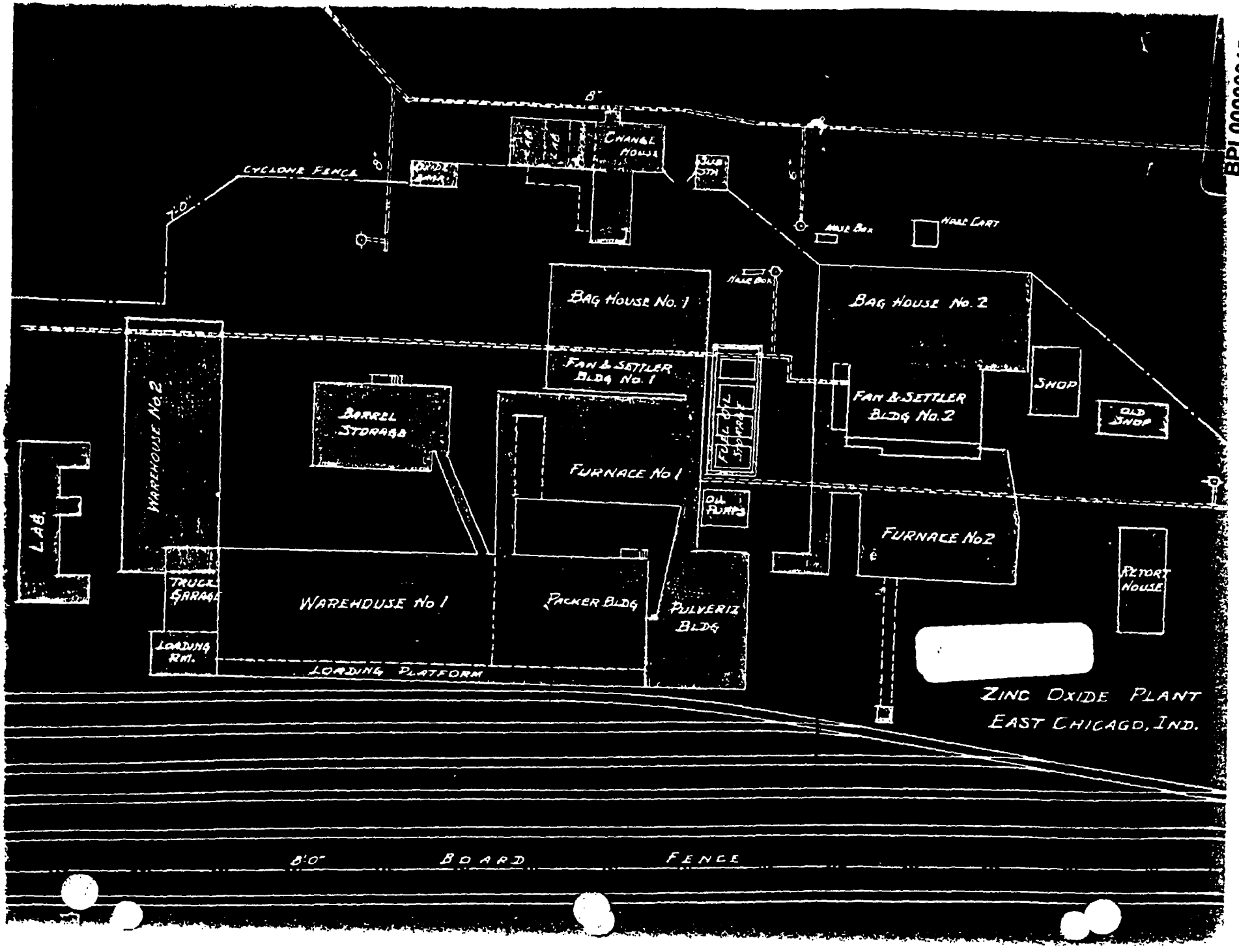

BAG HOUSE
SETTLER HOUSE
FAN
FAN
STORAGE
STORAGE
FURNACE
FIRING FLOOR
BRICK FLUES
AMERICAN OXIDE PLANT
EXPERIMENTAL UNIT.
EAST CHICAGO IND.



Estimated Cost of Plant Extension

East Chicago Spring 1922.

Assumes -

1 - One unit French Oxide Furnace

2 - One unit American Oxide Furnace.

These are to be apart of the final East Chicago plant. They may be largely used in the paint trade in that section. Beginning these at once would allow us to continue in a market already opened up. They can operate with the 5-1/2 ton semi-commercial plant already running.

They would give a total production at East Chicago of 17-1/2 tons of oxide daily.

The choice of sites for such extension lies between a plot at the extreme northwest corner of your property and that area directly west of the present small plot.

In the former case a more isolated and roomier layout can be obtained. It has these disadvantages at the same time over the second site.

1 - A greater expense resulting from longer tracks, more oil equipment and tanks, a new laboratory and office, power lines, fencing, etc. It will be capable of expansion, however, to any size which might ever be warranted by the trade.

The second site will in all probabilities be large enough. It is shown in L-401-1 G and could be expended to 40 tons daily. It has the disadvantage of being nearer the other plants, but this I do not regard as serious. I believe with a small expense the present oil burning equipment could be used without interference of your refinery. It has a further advantage of a rapid construction job, which should not be overlooked.

There is no question but that the northern site will appeal more strongly from a straight engineering point of view. I believe, however, that the time element in shaping this business is a factor of as much weight as any other one. If we can keep some of their business right through the current year it will be much to our advantage in getting the market expansion later when we are producing regularly.

I recommend the closest study in balancing these opposing angles of the problem as a whole. Building a broad and sound market is as critical an element as is the manufacturing side right now; in fact, it is more important than having every possible refinement of plant.

North Site.

(Shown on L-401-1X)

French Block (6 tons daily)

Furnace Building	$2,400.00
" " Equipment	4,650.00
Settler & Fan Building	2,400.00
" " " " Equipment	8,700.00
Warehouse, Packing House, etc.	5,200.00
" " " equipment	4,400.00
Bag House Building	2,000.00
" " Equipment	400.00
Boiler House	1,230.00
" " Equipment	2,300.00
Oil Tanks & Pipe Lines	900.00
Change House	1,500.00
" " Equipment	2,200.00
Standard Gauge Railroad	9,600.00
Truck Roads (concrete)	2,000.00
Sewers and drains	800.00
Water Lines	700.00
Power Lines	2,000.00
Engineering	3,000.00
Total - - - - - - -	$56,380.00
Say	$57,000.00

North Site

American Block $60,000.00

Shown on L-401-1X

West Site as shown L-401-1C

Will include - 1 French furnace and
1 American block with
proper storage 110,000.00

The capacity would be 17-1/2 tons oxide daily. It is capable of some expansion, but not as much as the north site. It is referred to as Scheme #4.

Preliminary Estimate of One Furnace and Storage at Akron.

Land @ ($1,000. an acre)	$6,000.00
Furnace Building	2,400.00
" " Equipment	4,650.00
Settler & Fan Building	2,400.00
" " " Equipment	8,700.00
Warehouse, Packing House, etc.	10,000.00
" " " Equipment	4,400.00
Bag House Building	2,000.00
" " Equipment	400.00
Power House	1,200.00
" " Equipment	2,300.00
Oil Tanks & Pipe Lines	900.00
Change House	1,500.00
" " Equipment	2,200.00
Truck Roads	2,000.00
Sewers & Drains	800.00
Water Lines	700.00
Power Lines	2,000.00
Engineering	4,000.00
Total - - - - -	$59,780.00
Outside of Land and Storage	$43,000.00

If one location only is to be developed I recommend Akron, following up as soon as we can with East Chicago extensions.

At Akron I would put:

1 - French Furnace, with Storage.

At East Chicago:

1 - French Furnace
1 - American Furance

This new work only calls for a total of 3 furnaces, with a total production of 28 tons of oxide daily.

Estimated Cash Requirements:

Scheme #1	- Two Plant Scheme (with North Site at East Chicago)	$177,000.00
" #2	- Two Plant Scheme with West Site at East Chicago	170,000.00
" #3	- One Plant Scheme, Akron	60,000.00
" #4	- One Plant Scheme (with American Unit East Chicago) West Site	110,000.00

I would therefore recommend Scheme #1 for immediate construction, giving at Akron 1 Furnace and Storage, with a capacity of 7-1/2 tons oxide daily. In addition one American furnace and one French furnace at East Chicago with a capacity of 10 tons and 7-1/2 tons oxide daily, respectively. The combined capacity of the new plants would then be 25 tons oxide daily. The entire cost will be about $177,000.00.

chiefly in poison sprays and dusts in destroying insects which injure fruits and vegetables, such as the codling moth, plum curculio, cabbage worm, potato bug, and nearly a dozen other similar pests. The same quantity of calcium arsenate was used against the cotton boll weevil, the alfalfa weevil, and other insects affecting fiber and forage crops.

Effective to the highest degree, arsenic compounds protect wood structures against fungus and insect destroyers. Widely used in Australia and South Africa for many years, arsenic compounds are effectively preserving mine timbers, telephone and telegraph poles, fence posts, and railroad ties against decay. Several million pounds are now used annually for these purposes in the United States. Arsenic compounds also play an important part as weed destroyers along railroad rights-of-way.

The Anaconda company produces annually approximately 50 per cent of the total quantity of white arsenic produced in the United States, which has nation-wide distribution in the agricultural industry.

French Process Modernized by Anaconda in Production of Zinc Oxide at East Chicago

By F. O. CASE

Manager, Anaconda Zinc Oxide Department

MODERN electrochemistry plus an old metallurgical process—thus, in brief, is outlined the production of Anaconda zinc oxide. The raw material, Anaconda electrolytic zinc, is shipped to East Chicago, Ind., and Akron, Ohio, at which the plants are situated for converting it into zinc oxide by the French process.

Zinc oxide is a very white pigment, and, as referred to in this article, is a commercially pure oxide of zinc. Commercially, zinc oxide is manufactured by two processes. The older and indirect process is called the French process; the other and newer is the American process. In the former, zinc metal is distilled in suitable furnaces and the vapor oxidized. In the American process, zinc ore is reduced by the carbon in hard coal or coke and the resulting zinc vapor is immediately volatilized and oxidized to zinc oxide. Each process has its disadvantages; the French process is usually limited on account of cost, especially where low-grade oxides are produced; the American gives a low recovery of zinc and also involves contamination of the finished oxides.

The production of Anaconda zinc oxide by the French process was started in December, 1921, with a small pilot unit at East Chicago. The first commercial unit was erected there early in 1922 and started operation in June. Also, a duplicate was erected the same year at Akron to serve the rubber industries. Akron started operation in January, 1923, and during the summer of that year the capacity of each plant was more than doubled. Except for minor improvements and repairs, all units have been operating continually since completion.

Before Anaconda's work it was assumed by many that zinc oxide of this character was not suitable for paints nor use in rubber compounds, but the results obtained by our customers during the last seven years have amply demonstrated the fallacy of this belief. When Anaconda electrolytic zinc is used as a raw material, the resulting oxide is not only chemically purer but physically better adapted for use in paint and rubber than American process zinc oxide. Paints made from French process zinc oxide are not only whiter but wear better than those made from American process oxide. Rubber compounds are superior because the finer grain size of the French process oxide gives greater resistance to abrasion.

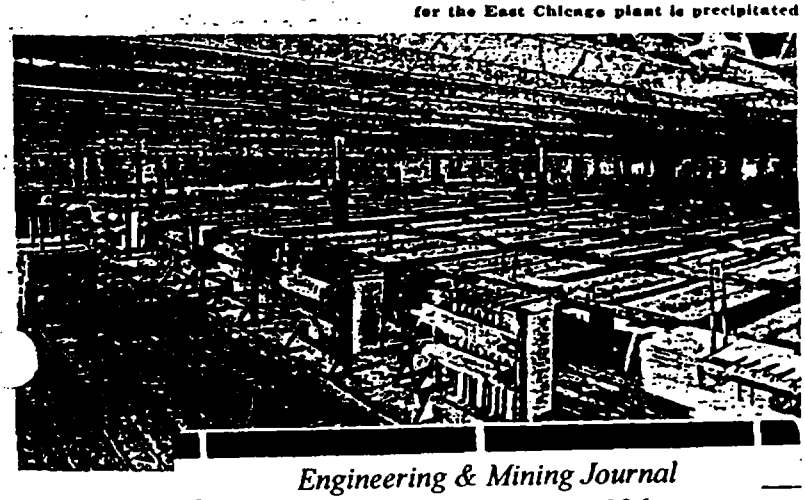
The French process as carried out at the Anaconda plants differs from the older practice not only in the construction of the furnaces and other equipment, but also because all parts of the manufacturing cycle are variable and are under control. Fuel oil furnishes the heat for the furnaces, and the temperature is always uniform, depending upon the grade of material being produced. The rate of oxidation of the zinc to zinc oxide is controlled by regulating both the amount of zinc vapor produced and the volume and temperature of air used for oxidation. This air is moved and controlled by large Buffalo Forge fans connected to variable speed Reeves controls. The temperature and humidity of this air are also kept uniform.

After oxidation, the mixture of zinc oxide and air is cooled, passed through settling and classifying chambers, and then the zinc oxide is filtered out by passing the oxide-laden gases through muslin or woolen bags. A rough classification of zinc oxide into various particle sizes is made by the settling chambers and baghouses.

By selection of raw material and suitable control in the manufacturing cycle, Anaconda makes the following grades of zinc oxide: Pharmaceutical (U.S.P.), White Seal, Green Seal, Red Seal, Selected and Special Lead-Free. Lead-Free Zinc Oxide with a very fine grain size, and ordinary Lead-Free Zinc Oxide. The Pharmaceutical grade is used in cosmetic and medicinal preparations. Red, Green, and White Seal grades are used in enamels, lacquers, printing ink, and other products demanding various properties found only in a high-grade zinc oxide pigment. The Lead-Free grades are used in paints and rubber compounds. The extremely fine-grained zinc oxide is used in rubber compounds where great strength and resistance to abrasion are needed, such as heavy-duty high-grade tires.

The production and sale during the last seven years of large tonnages of Anaconda zinc oxides have not only overcome the prejudice against French process zinc oxides, but have clearly shown their superiority. This is the logical and obvious result of using a superpure raw material—Anaconda electrolytic zinc—and a controlled manufacturing process that prevents contamination of the finished product.

Interior of electrolyzing division at Great Falls, where the pure metal for the East Chicago plant is precipitated



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measure of artificial aging than the increase in the acetone act, which has always been determined. Experiments in this ection are under consideration and will be carried out shortly.

Résumé

A method has been worked out for isolating the oxidation prod- in the alcoholic potash extract of vulcanized rubber. It is n that, during the initial stages of oxidation, the percentage xidation products increases much more rapidly than the acetone act, and that therefore this fact is to be considered a very portant chemical aid in studying oxidation in its initial stages. further oxidation, oxidation products are formed which are oluble in ether.

Systematic experiments were carried out on the formation of e products during vulcanization and during the oxidation urring on aging.

The oxidation products formed during vulcanization and during ural and accelerated aging were carefully analyzed. The carbon hydrogen were determined by the precise method of Heslinga, ile the oxygen was determined by difference. It was found that oxygen content of the ether-soluble oxidation products was ween 4% and 5%, while that of the products insoluble in ether s between 7% and 8%.

Some theoretical considerations were mentioned, and finally the portance of determining the oxidation products in establishing quality of rubber goods was pointed out, and several examples en.

Notes

[1] Ter Meulen and Heslinga, *Neue Methoden der organischchemischen alyse*, 1927, 7 (Leipzig, Akad. Verlags-Ges.).
[2] *Ind. Eng. Chem.* 14, 139 (1922).
[3] *Trans. Inst. Rubber Industry*, 3, 203 (1927).
[4] *Kolloid-Z.* 13, 49 (1913).
[5] *Handbuch der Biochemie des Menschen und der Tiere*, 2nd Ed. 1925, 252.
[6] It may be remarked that this condensation does not occur due to the sence of sulfuric acid, as similar oxidation products are found in raw ber on oxidation.

Anaconda Zinc Oxide

THE Anaconda Zinc Oxide Department of the International Lead Refining Company is now manufacturing Red, Green and White Seal French Process inc oxides, pharmaceutical zinc oxide, and also selected and ead free grades which are of particular interest to the ubber trade. In addition, this organization sells the output of basic carbonate of white lead of the Anaconda Lead Products Company, East Chicago, Ind.

Three sales offices are now maintained for the distribution of these products, the general office being at East Chicago, Ind. The district office at Akron, O., is in charge of L. G. Duncan, and another district office at 25 Broadway, New York City, is in charge of D. M. Tobey. The company has agents in Philadelphia, Baltimore, Louisville, Cincinnati, St. Louis, Kansas City, Fort Worth, Dallas, Denver, Seattle, San Francisco, Los Angeles and Portland, Ore. In Canada agents are maintained at Toronto and Montreal. Warehouse stocks are also maintained in the cities having agents, as well as Brooklyn, Newark, Boston, Indianapolis, Minneapolis, and St. Paul.

It was late in 1921 that F. O. Case and G. S. Brooks of the Anaconda organization started up a pilot plant for the manufacture of zinc oxide at East Chicago. Details were worked out on this unit, and in the spring of 1922 a large unit was designed and built at the same location. Further work was carried out and it was decided to erect a plant at Akron, O. The first unit was constructed in the last part of 1922 and began operation the following year. Also in 1923, a large furnace was built at each factory, thereby increasing production to 60 tons per day at each of the two plants. All of these units were of the French process type.

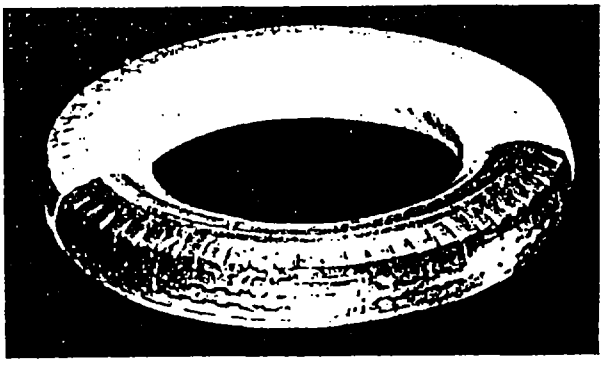
In 1925, an American process unit was erected at Akron. This has since been enlarged, and some of the experimental parts have been replaced by permanent steel, sheet iron and concrete construction.

Cellophane Wrapping on Tires

A NEW form of tire covering is being adopted by at least two tire manufacturers for their super or de luxe brands of tires, by using Cellophane as a wrapper below the outside kraft paper wrapper.

The General Tire Company is now using this Cellophane wrapping on their Super-Dual 8-ply balloon tire—a tire that sells at approximately $60.

The Swinehart Tire & Rubber Company is also doing the same with their Imperial custom built tire. Both of these



The transparent wrapping completely covers the tire. The overlaying kraft paper wrapper has been partly removed

casings are essentially quality products and the companies have adopted transparent Cellophane coverings to give these tires a finishing touch to indicate their highest grade product.

The wrapping is made with two-inch Cellophane with an overwrap of kraft paper which can be removed by the dealer and the tire placed on display in its transparent covering. In addition to the inference of high quality, the transparent wrapper protects the tire also in that it allows the individual tread, as well as the name, number and embossing to be seen at a glance. When the tire is sent out it is washed in a glycerin solution to give it a glossy appearance and should the tire be rolled around without any covering in the display room it will naturally pick up dust and become dirty very easily. The Cellophane wrapping prevents this.

Captax Output Increased

THE addition to the plant manufacturing Captax, made in April by the Goodyear Tire and Rubber Company, Akron, O., increases the plant capacity from 300,000 to 450,000 pounds per month. Another plant is being rushed to completion which will give an additional capacity of 300,000 pounds per month. This plant, which is expected to be ready within 60 days, is entirely apart from the present building and gives added insurance against fire hazards. The Toronto plant, which was put into operation last fall, is to be doubled as quickly as possible to increase its capacity to 150,000 pounds per month. All plants are operating at capacity including nights and Sundays. The R. T. Vanderbilt Company, New York City, are selling agents for Captax.

Dill Announces New Unit

THE new display unit being announced by the Dill Manufacturing Company, Cleveland, contains a repre-

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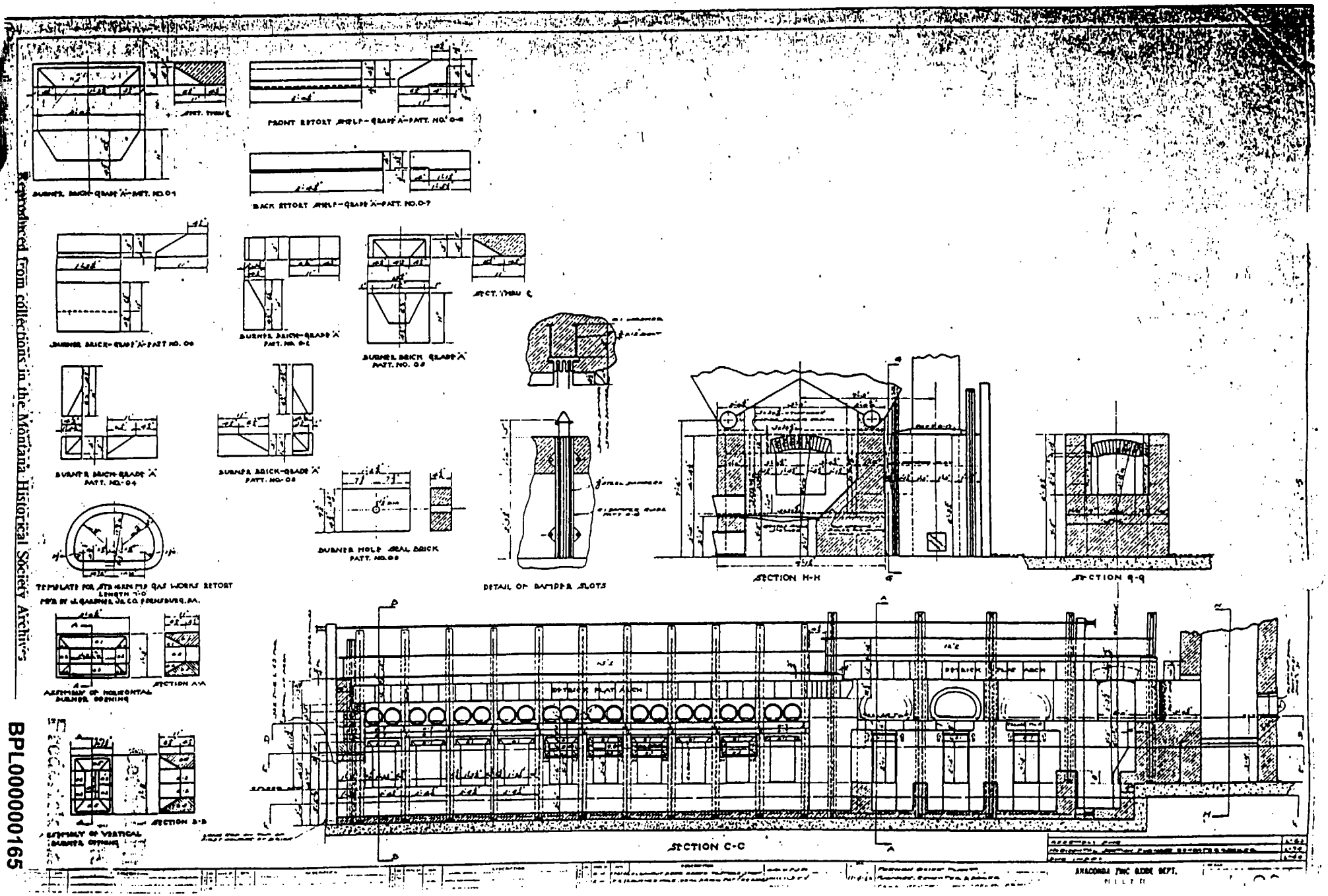

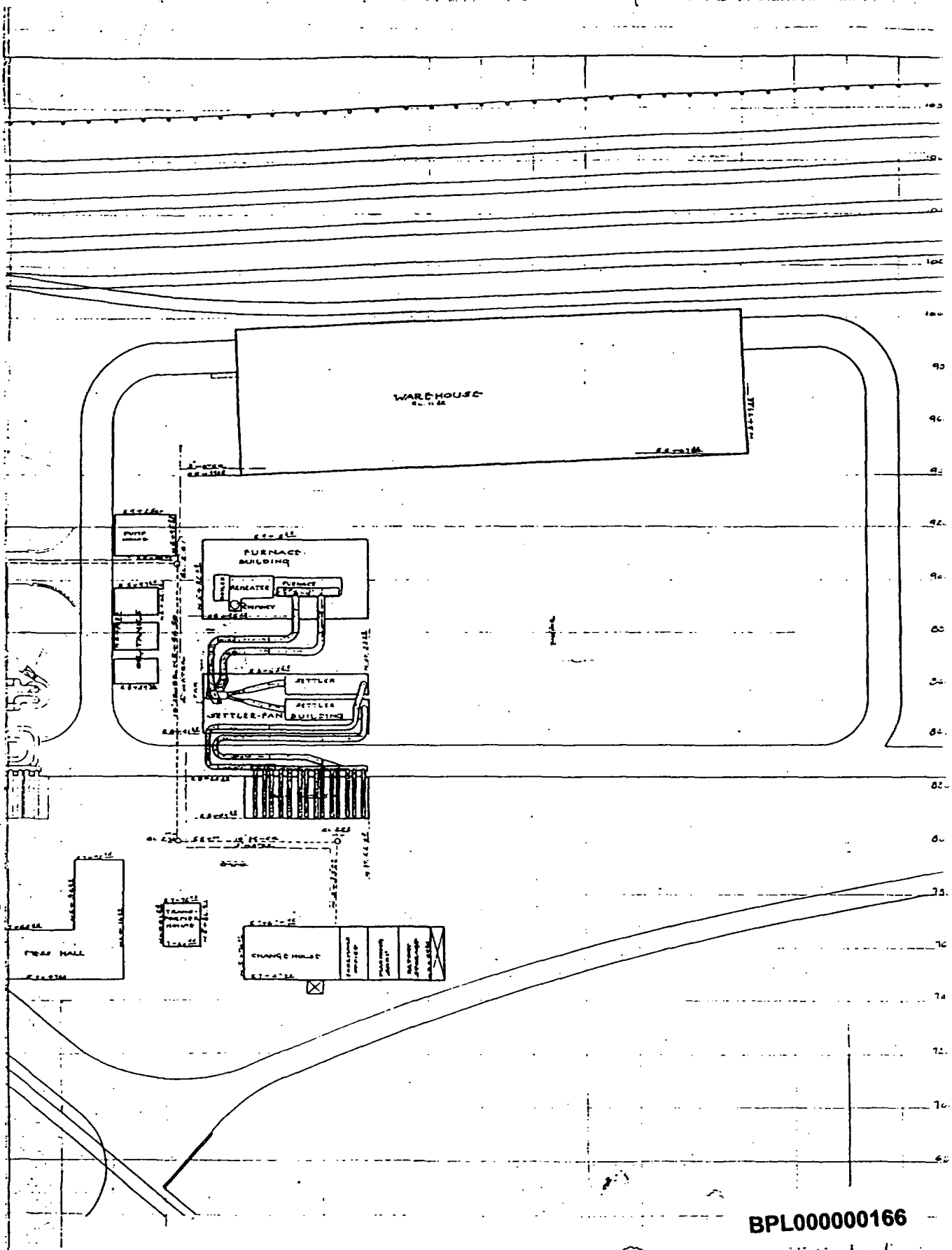

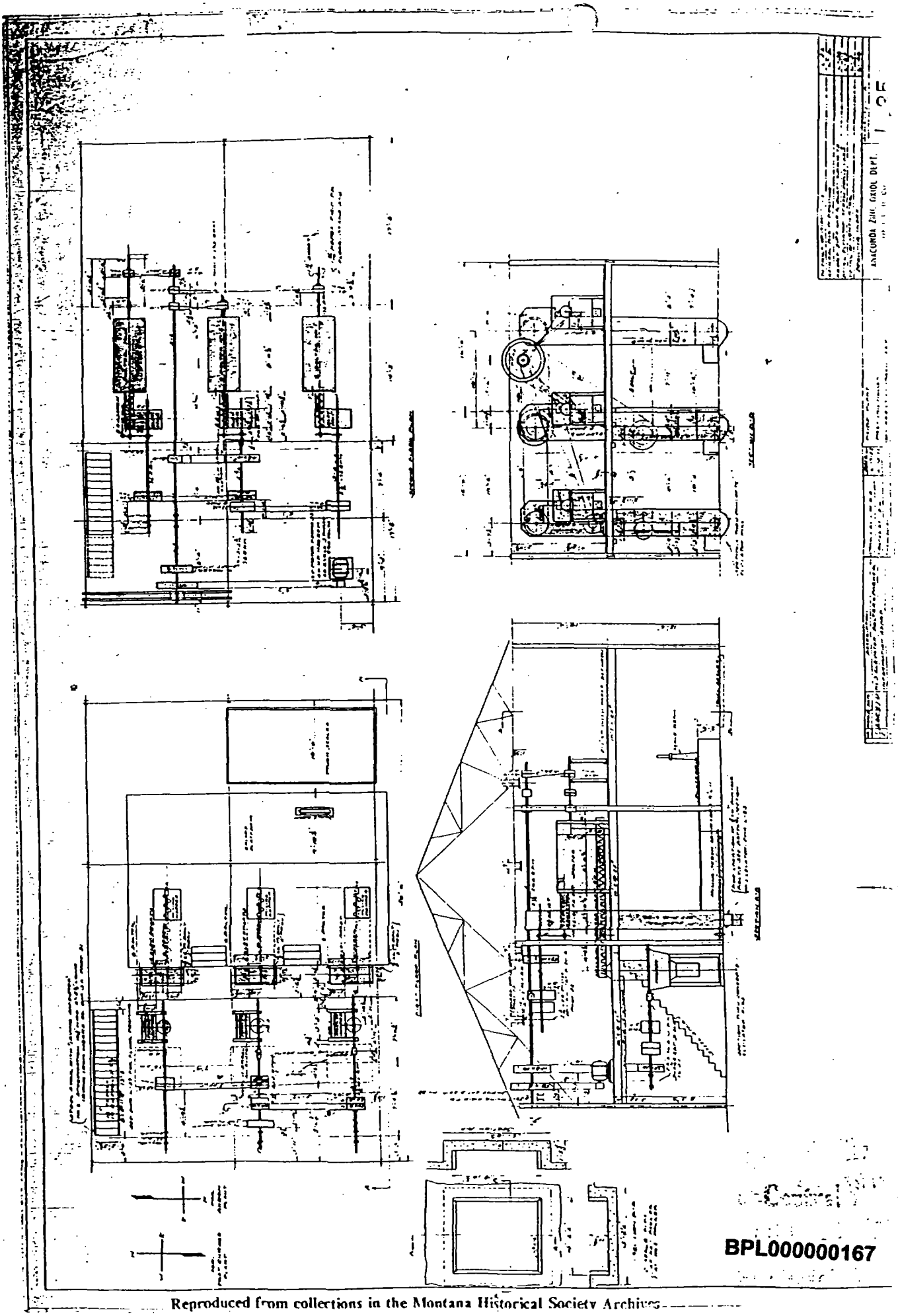

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